MEDICAL

THERMOMETRY

AND

HUMAN TEMPERATURE.

BY

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TO

DR. EDWARD CONSTANT SEGUIN,

CLINICAL PROFESSOR OF DISEASES OF THE MIND AND NERVOUS SYSTEM IN THE NEW YORK COLLEGE OF PHYSICIANS AND SURGEONS:

MY DEAR SON,

As you are one of the young medical men who have given their night and day cares to the introduction of Thermometry in the New York Hospital, and have since brought higher in professional esteem the name of your revered grandfather and of several kinsmen, it is with a double sense of justice and of paternal satisfaction that I dedicate to you, for the second time, this work of my old age.

E. SEGUIN.

NEW YORK, 1*st January*, 1876.

17 WEST TWENTY-FIRST STREET.

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PREFACE.

THE first edition of this work has been for a long time exhausted. Circumstances dependent on its author, though independent of his willingness, have retarded the issue of this much demanded second edition. It will be found to contain the material to which the success of the first was due; the restoration of old observations containing germinal truth yet undeveloped; the latest thermic experiences which could be gathered to date; an exposition of the progress accomplished, and of that desired in thermometry and in thermography; an appendix of observations supporting the doctrines exposed, and an abundant bibliography.

By the force of its documentary evidences this book is from Wunderlich, Roger, Sidney Ringer, Liebermeister, Charcot, William Squire, Bourneville, Radouan, Lépine, Wilson Fox, Bärensprung, J. Jones, Alvarenga, Jaccoud, Redard, Paul Bert, Claude Bernard, Brown-Séquard. By its unity of plan, and by the convergence given to these documents towards an Hippocratic Renaissance, I am bound to not decline its authorship.

E. SEGUIN.

INTRODUCTION.

"HUMAN thermometry will render such services in families, in schools, and in society, that we must not tire of preaching it till public opinion will be fully aware of its usefulness."—E. LITTRÉ, *de l'Institut de France.*

Human temperature and human thermometry have become so correlated and as it were knit together by the labors of the last thirty years, that we cannot well form a conceps of one without completing it with the other. Even in history we see these ideas entwined *duo in uno*: effect of their mutual dependence.

When the knowledge of the body-temperature in the practice of physic shrank and finally disappeared from the stores of antiquity, it was because the improvement in the means of perceiving and recording pathological temperatures had not kept pace with the advance of the contemporary doctrine of the crisis and critical *ustions.* Though history does not repeat itself, its mechanical process of generating events is so uniform that the last terms of a progression foretell the next: sorcery is mathematics.

We have ascertained how the study of the body-temperature became obsolete with the ancients (*see* HISTORIC); to foretell its next move, let us see how the same law of historic evolution applies to the pulse knowledge. Sphygmometry had declined from its Galenic prestige to mere guess-work or to make-believe, by want of *tactile education*, of instruments, and of method, when the simultaneous discovery of Harvey and the general use of watches rendered possible and positive the numeration of the pulse-beat, and made it available in exact diagnosis.

True, the watch left unrecorded other properties of the pulse, and unsuspected the most delicate principles of the circulation, whose ignorance led to blood-thirsty theories. This called for a reaction which might have been predicted.

At the very time when even the lifelong phlebotomist was looking

unto himself with suspicion, Vierordt invented and Marey perfected the sphygmograph—besides a magnificent series of other self-registering instruments—by which other properties of the pulse and heart-beat were recorded. The result was a revolution, which theoretically restored the pulse, not to its supremacy above, but to its proper place among the sign-bearers of diseases; and, by giving a better idea of the rate of the circulation, practically opened the way to more blood-letting in, than to blood-letting out.

Now, by adapting the mathematics of this recent period of the history of sphygmography to the coming period of clinical thermometry, we find that the last progress in the conceps of human temperature, and the last applications of this conceps to therapeutics, etc., were due to the extraordinary energy of men who exacted their facts and laws from imperfect instruments and discordant methods. We cannot fail to note further that these instruments and methods have not of late been improved in accordance with the urgent demands of pathology, therapeutics, physiology, education, and other great social interests; and that, consequently, if thermometry has made many proselytes, thermography has not been improved, and the knowledge of human temperature has not advanced as was expected it would.

Therefore, the mathematics of the subject foretells that the next progress must be about *Human Thermometry*, and bear on the simplicity and delicacy of the instruments, the unity of their scale, and the uniformity of the thermography used by the physicians of all nations.

Only then will become possible the *second* next progress about *Human Temperature*, consisting in the discovery of new laws of pathologic *ustion*, of the thermic action of remedies, diet, mesology, hæmospasia, etc., not only on the sick but on the growing ones; progress which will more than double the field of activity, influence, and usefulness of our profession.

To prepare these conclusions it has been necessary to study the two sides of *the subject*, as if it were *two subjects*. But by keeping their *unity of object* in view, the intelligent reader will reciprocally enlighten both, till they will fuse in his mind as one single idea.

We begin, agreeably to this plan, with a short historical sketch of the mother-idea of clinical thermometry.

PART FIRST.

HUMAN TEMPERATURE.

PART FIRST.

HUMAN TEMPERATURE.

CHAPTER I.

HISTORIC.

In the earliest ages of medicine the significance of temperature as a symptom in maladies was fully recognized. The Greek and Latin names for fever signify elevation of temperature.

By Hippocrates, heat was deemed the chief diagnostic sign of acute diseases; around it were grouped all the symptoms, and upon it, as on a pivot, hinged the remarkable, and not yet equalled, unity of observation of the school of Cos.

Little by little, however, the pulse, being studied under the Ptolemies, took the prominent place in diagnosis. But soon the savage and bigoted interruption of the courses of anatomy and of experimental physiology in Alexandria—the same which threatens us to-day—having left unconnected the streaks of light thrown upon the mechanism of the vascular system, medical observation was unable to seize and trace the law of circulation, even with the finger of a Galen on the pulse-beat; and having lost, after Erasistrates, the Hippocratic tradition of prognosis by temperatures, having no other guide than credulity to authority, darkness began and spread with the swiftness of a tropical night.

After ages during which physic and true physicians suffered as much as mankind itself under the pressure of medical theurgism, the revival of anatomy rendering again possible the demonstration of the circulatory system, served to restore to diagnosis its Galenic unity around sphygmometry. Soon experimental physiology went further, and finding at the foundation of all the phenomena of life the *radical* CALOR, reopened the Hippocratic question: *De Calore in Morbo.*

After centuries of apparent neglect of temperature as a factor in disease, Sanctorius* applied a thermometer of his own invention to the determination of human temperature. Sanctorius pleaded the concordant importance of the determination in disease of temperature and body-weight (to measure which he also invented a weighing-chair). After him Boerhaave and Van Swieten were the first known to have attached a clinical importance to temperature. But to De Haen, of Vienna, belongs the honor of having introduced thermometry in the practice and in the teaching of medicine.

Experience had led De Haen to leave the thermometer *in situ* seven and a half minutes, and to add one or two degrees Fahrenheit to the registered temperature. However imperfect this method, it afforded him valuable data, which have been confirmed—even rediscovered since. His thermometrical labors are dispersed through the fifteen volumes of his *Ratio Medendi.*

De Haen observed the temperature of healthy people of various ages, and was the first to remark the high temperature of the aged. In various parts of his work are proofs of his application of thermometry to diagnosis and prognosis. He was aware of the morning remission and evening exacerbation of temperature in fevers; of the rise of temperature during the febrile rigor (fieber frost); of the persistence of fever temperatures after intermittent fevers have apparently been cured; and of the discrepancies between pulse and temperature in some patients and in certain diseases; he knew the contrast between the subjective feeling of warmth or cold as felt by the patient, and the objective temperature *as per* thermometry; he used the changes of temperature as therapeutical means; and regarded the return to normal temperature as a proof of con-

* Born in Capo d'Istria in 1561, teacher of Medicine in the University of Padua from 1600 to his death, in 1636.

valescence. He advocated his own theories on animal heat with considerable perseverance and ardor.

In spite of his great fame, the discoveries of de Haen were neglected, and medical thermometry was once more abandoned after his death.

In England Ch. Martin published the first accurate observations on temperature in healthy men and animals, *De Animalium Calore*, 1740. The followers of Haller experimented in various directions upon human temperature, and Blagden discovered the notable fact that an ambient temperature of 212° Fahr. cannot sensibly modify the vital temperature of a healthy man.

John Hunter began (1775–78) to publish his experiments on temperature in the *Philosophical Transactions;* and was the first to remark the local elevation of temperature in inflammation, after an operation for hydrocele.

Shortly after, the celebrated work *Sur la Chaleur* (*Mem. de l'Académie*, 1780) was published in France by Lavoisier, the discoverer of oxygen. In collaboration with Laplace—himself second to none—he investigated the causes of animal heat, and attributed it to the chemical combinations of oxygen with hydrogen and carbon in respiration. He says: "The animal machine has three regulators: respiration, which consumes hydrogen and carbon and produces heat; transpiration, which, according to the necessities of the case, lowers the temperature and cools the body; and digestion, which restores to the blood what it has lost." He places the seat of warmth-production (combustion) in the lungs. These discoveries and doctrines gave to human thermometry a broader impulse than the one we have witnessed these thirty years, under the leadership of pathologists. Everybody then wanted to add something to organic thermonomy, as conceived by the father of modern chemistry.

Crawford (*De Calore Animalium*, 1779–86) sought the source of heat in the chemical processes in the lungs, and tried to explain the pathological changes of temperature and the local temperature of inflamed parts.

James Currie published in 1797 *Medical Reports on the Effect of Water, Cold and Warm, as a Remedy in Fever and other Diseases.* For the first time since De Haen, the observation of temperature was by him made available for medical

purposes, and especially as a means of controlling therapeutic experiments. Each case has its temperature recorded; thermometry pervades the whole of Currie's practice; nevertheless, it influenced very little the medical profession. So that for many years his *Medical Reports* stood alone, like the Giant's Causeway, a melancholy monument of what a single man can conceive, and the many cannot comprehend.

No less astonishing, but farther related to therapeutics, was the discovery of Ben. Thomson (Comte Rumford), of the identity of movement and caloric—a principle which comprised within itself the later discoveries of Meyer and Joulé, and fruitful in physiological and medical applications.

Vacca Berlinghieri, Buntzen, Coleman (*Dissertation on Suspended Respiration*, 1791), and Saissy (*Recherches sur la Physique des Animaux Hybernans*, 1808), added some interesting facts. Sir B. Brodie published, in 1811, *Some Physiological Researches respecting the Influence of the Brain on the Action of the Heart, and on the Generation of Animal Heat*, and *Further Experiments* on the same subject, in *Philosophical Transactions*, 1812, p. 378. Dalton and John Davy opposed his views on the source of animal heat; Nasse and Earle supported them. The labors of Hale and Legallois also deserve mention here.

Chossat (Thèse, Paris, 1820), *Sur l'Influence du Système Nerveux sur la Chaleur Animale*, supported by a great number of experiments the opinion that "the source of animal heat was to be sought in the sympathetic nerve." In the course of the discussion which followed this important paper, Dulong and Despretz (1822–23) decided in favor of Lavoisier's theory. At the same time Gentil observed the variations of temperature according to age, sex, temperament, etc.; and Thomson the production of heat in an inflamed part (in Meckel's *Archives*, v. 405).

In 1821 Hufeland offered a prize for the demonstration of Currie's theory and method of treatment. The prize essays of Anton Frölich and Renss (published in *Hufeland's Journal*, 1822) contain many valuable contributions to pathological thermometry. Bailly wrote a *Mémoire sur l'Altération de la Chaleur Animale dans les Fièvres Algides* (*Revue Médicale*, 1825, v. 384); and Edwards (1824), in *De l'Influence des Agents Physiques sur la Vie*, gave a *résumé* of all that was then known about temperature.

These thirty years gave few methodical and comprehensive results of temperature in health or in disease.

But a new era opened in 1835, when Becquerel and Breschet published their researches on human temperature (in *Annales des Sciences Naturelles*, Zoologie, tom. iii., iv., et ix.). Although they regarded pathological conditions but slightly, they tested the variations of temperature in different parts of the bodies of men and animals by means of extraordinary sensitive thermo-electric apparatus. They found the temperature of inflamed parts higher than that of the healthy ones; and established the mean healthy temperature of man at 37° Centigrade = 98.6° Fahr. This was the corner-stone of the new edifice, Medical Thermometry.

Another production of great merit, but with no pathological bearing, was the Zoo-physiological treatise of Berger, determining the temperature in various species of animals, *Faits Relatifs à la Construction d'une Echelle de Degrés de la Chaleur Animale* (in *Mémoires de la Société de Genève*, tom. v., part 2, tom. vii., part 1). Edwards furnished a comprehensive article in Todd's *Cyclopedia*, vol. ii., p. 648, 1836-39. Collard de Martigny published in 1836: *De l'Influence de la Circulation Générale et Pulmonare sur la Chaleur du Sang*. P. H. Bérard wrote the physiological, and Chomel the pathological part, of the article "Warmth," in the *Medical Dictionary* 32 vols.). Bouilland and Donné used thermometry in their practice. Piorry had a thermometer added to his stethoscope, urged the necessity of even measuring the temperature of the skin, and strengthened the claim of the thermometer by repeating this prophetic utterance of Biot: "Lorsqu'on voit tant de résultats obtenus par le seul secours d'un peu de mercure enfermé dans un tube de verre, et qu'on songe qu'un morceau de fer suspendu sur un pivot a fait découvrir le Nouveau Monde, on conçoit que rien de ce qui peut agrandir et perfectionner les sens de l'homme ne doit être pris en légère considération."

In 1837 Sir B. Brodie made known his experiments "On the Elevation of the Temperature after the Division of the Spinal Cord, etc." (*Med. Chir. Transact.*, vol. xx., p. 118). Wistinghausen, Fricke of Hamburg, and Friedrich Nasse furnished valuable contributions, at the same time (1839) that Gavarret confirmed (in the *Journal l'Expérience*) several of the almost forgotten discoveries of De Haen.

About 1840 thermometry took a new start when Andral, the then leader of progress, applied it like Currie, not only to individual cases, but to "map out the courses of temperature, and to find out their laws.". Still more valuable than Andral's *Lectures on General Pathology*, was the *Dissertation* of Gierçe, *On the Causes of Organic Heat in Inflamed Parts.* Hollman made many observations *On the Variations of Temperature in the Healthy, under various conditions and circumstances;* and Chossat completed his *Experimental Researches on Inanition* in 1838.

Of the same date are the investigations of Henri Roger (*De la Température chez les Enfants, à l'état Physiologique et Pathologique* published in *Arch. Gén.* 1844, and since in book-form, still highly valued. His thermometrical observations bear on the normal temperature of children at birth, during their first seven days, and later; then in ephemeral, intermittent typhoid fevers, small-pox, scarlatina, measles, erysipelas, rheumatism, pericarditis, cardiac hypertrophy, stomatitis, enteritis, dysentery, meningitis, encephalitis, laryngitis, bronchitis, pleurisy, and pneumonia; and further in tuberculosis, whooping-cough, chorea, dropsies, rickets, and paralysis, besides thrush and sclerema of newly-born infants. Finally, Dr. Roger sums up, in a practical manner, the result of these observations in diagnosis and prognosis. Such a wealth of thermometric facts had never been accumulated before; and though many of the observations are incomplete, and the generalizations lack the vigor of the Prussian school, one must not forget that they were without precedent, that ten years later it was easy to improve upon them, and that as they are, they cannot be dismissed with a compliment from a manual of thermometry.

Demarquay,* first in surgery like Roger in medicine, published in the *Archives Générales*, 1848, his experiments on the influence of pain, loss of blood, ligature, toxic agents, etc., on the temperature of animals; and, conjointly with Dumeril, *Experiments on the Lowering of Temperature by Ether and Chloroform*, and like Roger, in this latter respect, he has no reason to be thankful for the acknowledgment of his early and great services to surgical thermometry by his *confrères*.

Zimmermann, a military surgeon, advocated the cause warmly

* Lately deceased.—See Bibliography and *Surgical Thermometry.*

and furnished a great number of valuable facts. The dissertation: *De Calore in Morbo*, Bonn, 1849, of T. P. Schmitz, will not be forgotten, nor the teachings of Nasse on the same subject. Let us supplement these brief notices by an acknowledgment of the value and abundance of the thermometric observations of John Davy, which successively appeared from 1844 to 1863. He gave special attention to "The Temperature of Healthy Persons" as a basis for other observations; the temperature in advanced age; influence of the external temperatures on animal heat; diurnal fluctuations; influence of seasons, of active and passive exercise, of concentrated attention, of increased alimentation, of sea-sickness, etc., on temperature; with comparisons of the same in tropical and northern climates; and many subjects of lesser importance treated incidentally.

About 1846, chemists and physiologists took up the question—Fourcault, Flourens, Magendie, Helmholtz; Donders treated of *The Tissue-Changes as a Source of Heat in Plants and Animals;* Liebig referred the ultimate source of heat to chemical processes, and especially to slow combustion, and thus extended and fortified the doctrine of Lavoisier.

After this, it was only necessary for physicists to complete the idea of *temperature*, and its applications to physiology and pathology would follow as a matter of course. More or less directly, three or four men did it;—but, be it remembered, long after B. Thomson (Comte Rumford).—First, J. R. Mayer, of Heilbronn, declared (1842–45) the essential *unity of the so-called imponderables*, by which the chemical processes which appear,—as, light from the sun, disengagement of heat, mechanical motion, electric affinities, etc.,—are converted into a single force or power. This doctrine of the "unity and correlation of forces" was a perfectly new idea: *Ex nihilo nil fit, nil fit ut nihilum.* The effect equals the cause; the operation of force is again force in its turn. In truth, there is but one real force which runs through an eternally changing round in dead as in living Nature. There, as here, there is no progress, unless the force changes its form. Heat is a force, it becomes changed into motion. Chemical difference is a force, the changing of chemical difference into heat results from combustion. In all chemical and physical changes the given power always maintains a constant magnitude. The sole cause of animal heat is a chemical process, a kind of oxidation. The chemical force

which is contained in the food ingested and in the oxygen inhaled, is the source of two manifestations of power, viz., motion and warmth; and the sum of the physical power of any animal is equivalent to that of the simultaneously produced chemical processes. Mayer made application of this theory to some pathological, and to many physiological phenomena.

This *Novum Organum* was too much for the medical public, who needed the authority of Helmholtz to pay it any attention. To Joule, of Manchester, belongs the honor of having experimentally demonstrated the absolute and unchangeable relation between heat and mechanical power; and of having shown that a given quantity of power produced a determinate quantity of heat; conversely, that the quantity of heat which would raise a given quantity of water one degree, would (if otherwise applied) perform exactly an equivalent amount of mechanical work. In other words, the heat capable of increasing the temperature of one gramme of water by 1° C. is equivalent to a force represented by the fall of 423.55 grammes through the space of one metre. This is consequently the effect of *a unit of heat* or *calorie*, called the *kilogrammeter*.

Finally, Hirn, of Colmar, showed, with mathematical positiveness, that, whilst at work, the production of heat never corresponded to the oxygen consumed; much of it being changed into work: instead of the missing heat, so much work was done. This can give but a faint idea of the influence exercised by Dr. Mayer's theories of warmth-production. Physiologists and pathologists received from them a lasting impulse, since henceforth the temperature of the body became like all other, a force convertible, *i.e.*, manageable and subject to laws.

In consequence, Bärensprung and Traube, in 1850, began the new and henceforth endless series of pathologists who mainly founded diagnosis, prognosis, and, to a certain extent, therapeusis upon thermometric observation. Soon Traube discovered that the thermometer was the key to the derelict doctrine of the crises; for which he was soundly abused by some of those who now support it.

Ever since October, 1851, Wunderlich, induced by Traube's printed labors and spoken recommendations, introduced the use of the thermometer in his clinic. The number of cases thus studied amounted to nearly 25,000, and the number of single observations to some millions. When the number of the

latter reached 100,000, they appeared to him capable of serving as a basis for the determination of this most decisive question of pathology: Do certain diseases in their progress obey fixed laws or rules, and can this be determined and displayed by the course of the temperature? The affirmative answer was first afforded by the thermometric observation of typhoid fever, during the occurrence of a short epidemic of typhus.

This discovery was due, not only to a great mental effort, but to an uncommon power of discipline over other men of ability, his faithful assistants, Thierfelder, Uhle, Friedmann, Rotter, Nakonz, Giesler, Wolff, Blass, Thomas, Siegel, Schenkel, Treibmann, Friedlander, Heinze, Heubner, Stecher, Hankel, and zealous above all, his own son,—who died at the task in the hospital of Leipsic, in July, 1873. One week before I met the bereaved hero of medical thermometry,—I say hero, because, though the French, Roger, Jaccoud, etc., entered the field earlier, the Prussians won it. So stand the two nations in the contest; France established the norme, without which medical thermometry had no physiological basis, and Prussia discovered the first laws of pathological temperature. What a man alone can, the French did; what discipline carries, the Prussians conquered.

In the meanwhile, other nations had worked hard for the prize: in England, Aitken, the inventor of the self-registering thermometer; Ogle, J. Simon, Grimshaw, Woodman, the able translator of the New Sydenham Society edition of Wunderlich; the three Foxes, E. Long, Wilson, and Tilbury; Finlayson, who observed the temperature of tuberculosis in children; Sydney Ringer, who espied it in incipient phthisis of the adult; William Squire, who proved that in several respects private practice is a better field than hospitals for the cultivation of thermometry, etc.

In Italy, Maurice Schiff and Paolo Mantagazza gave the impulse; in Portugal, Alvarenga; in Brazil, Torres Homem; in Russia, Zorn.

This Republic may claim besides Rumford, J. S. Lombard, inventor of the most sensitive thermometer; L. D. Bulkley, who wrote a prize essay on thermometry; Dacquin, Benet-Dowler, Faget, J. Jones, Touatre, authors of valuable monographs on the temperature of diseases prevalent in the Southern States, yellow fever, dengue; and a host of excellent practical ther-

mometricians, whose observations have given such high tone to the American medical press.

But to-day, already, the defeated of yesterday present again a strong array—too many for my narrow roll-call: Charcot, with his brilliant staff of the Salpétrière; Vulpian at the École Pratique; Bert, Berthelot, Lorain, Potain, Sée, Jaccoud, Lépine, Bourneville, Dupuy, Radouan, Onimus in hospitals and private practice; Hirsh and Wurtz at the Ecole de Médecine; Claude Bernard and Marey at the Collége de France; Becquerel, Roger and Gavarret, old guards who neither surrender nor die; Brown-Séquard, present wherever discovery is needed.

In the impossibility of doing justice to all, I refer for omissions to the Bibliography, and resume this imperfect outline of the History of Medical Thermometry in its most salient phases.

The first, or Hippocratic, in which physicians had no other guides than their sense of touch, and the sensations of their patients.

The second, or Sanctorius', opened with the invention of the thermometer.

The third, or De Haen's, practical application of thermometry in the clinic.

The fourth, or Becquerel's, fundation of the NORME base of the numeration in mathematical diagnosis.

The fifth, or Wunderlich's, first demonstration of some *laws of ustion* in diseases.

The sixth, in which uniformized thermometry will be the centre of a *positive method* of observation, applicable not only to physic, but to insurance, labor, training, education; and the most rapid and direct improvement of our race. "If mankind can be improved, it will be through the progress of physic," says Descartes, the prince of the metaphysicians.

CHAPTER II.

PHYSIOLOGICAL TEMPERATURE.

Heat is the first and last manifestation of life we are made aware of, with our actual means of perception. Absolute privation of heat would be death; where there is heat there is life, patent or latent.

Inorganic bodies receive their sensible temperature from their surroundings when at rest, and chemical or other combinations develop in them sensible temperatures, which are their *ratio vivendi;* whose exhaustion shall be in turn their *ratio moriendi* (of desaggregation). But organized bodies have a sensible temperature of their own, with apparels to feed and distribute it, and others to regulate its safe-keeping and escape.

Our physiological temperature, *calor*, is produced by the conflict of oxygen with combustible substances: this conflict is the operation of the function we call ustion (*urere*, *bruler*, to burn).

The cause of human *ustion* must be sought in the chemical combinations which take place—not in one organ—but in the whole organism, and by which the formation of carbonic acid and water, urea, etc., is accompanied—like all labor or friction —by a degagement of heat or *calories.*

The forces which are changed into heat in the body are the chemical affinities of its own substance, and of the material introduced into it from without. Of these substances the most important, by far, is the blood, which, on account of its capacity for taking up oxygen, is the main agent of heat-production; and on account of its circulation *almost* equalizes the temperature of all the parts of the body.

Part of this *force-calor* is employed for self-preservation,

part is converted into productive activity, the rest is given off in a double operation of keep and escape (*a*) by the circulatory system, which—not unlike a hot-water calorifer—carries all over the body an almost uniform temperature; (*b*) by the skin, a large condensing apparatus, through which the excess of heat is converted into sweat, or escapes by radiation. Claude Bernard places the power of regulating the functions participant to *ustion* in the sympathetic. From the compensating action of this great harmonizer results the normal temperature of every living body, its NORME.

Every animal has its *norme* of temperature, which has been established for those nearer us (Appendix II.). Although subject to the law of diffusion of heat, their specific *calor* resists the permeating action of the ambient temperatures—be they higher or lower than the inward ones—with a tenacity which characterizes living organism. Even in the lowest forms of life, the inward temperature—this irrecusable assertion of the identity of the self—exceeds the ambient temperature by some tenths of a degree, at least. Flattering things have been said on the superiority of man over animals by Dogberry; but, at least, we can attribute to ourselves the greatest power of keeping our *norme* against the action of external temperatures, without making the ant shake its antennæ, and the bee curl its mandibles.

Birds have a higher temperature than mammals, and reptiles a lower one; man occupies the median place among the mammals which these latter occupy between birds and reptiles; he is the centre of the thermic scale.

I.—The Human Norme.

Ascertained by Becquerel and Brechet to be—

37° Centigrade scale.
29.6° Reaumur.
98.6° Fahrenheit.
77° Walferdin's tetracentigrade.
0° of the physiological scale.

(See Appendix I., *Table of Equivalents.*)

This norme must be the basis of all our judgments as to the significance of temperatures in disease, growth, labor, etc., and

the guide of our determinations in regards to the preservation and recovery of health.

For human temperature varies from this type. Besides its unhealthy variations, *perturbations* proper, resulting from excesses or sickness, there are *ecarts* from the norme, like those of the pendulum from its axis; and there are even displacements of the axis (norme) by age, climate, occupation, accident, etc., without sickness: anomalies, as normal for a few as the norme for mankind.

Let us explain the idea by its very application, and first to

II.—The Diurnal Oscillations.

Temperature varies a little, *oscillates*, even in healthy persons, accordingto the time of the day, by .5° C.=.9° F. Lichtenfels and Fröhlich state the time of the lowest from 10 P.M. to 1 A.M., and from 6 to 8 A.M.; the highest from 4 to 5 P.M. According to Damrosch the temperature rises from 7 to 10 A.M. about .5° C.=.9° F.; falls till 1 P.M. about .1°—.2° C.=.2°—.4° F. From thence till 5 P.M. it rises .2°—.3° C.=4°—.6° F.; and then falls again till 7 P.M. by about .3°—.5° C.=.6°—.9° F. Occasionally the afternoon fall is absent; the 7 to 10 A.M. elevation and the 5 to 7 P.M. fall are the most constant. (See Appendix III. *a.*—Ogle; *b.*—Alvarenga; *c.*—Bärensprung.) Ogle states an ecart of 1.5° F., Alvarenga excursi from .49° above the norme to .71° below it, total difference 1.20° C., average temperature 36.9° C. Finlayson, of Glasgow, found a daily excursus of 2° C. as the daily average of 283 observations taken on 18 children. Bärensprung (same Appendix, *c*) notes the excursus above the norme .49°, below .69° C.; total 1.18°. Like Alvarenga he notes the influence of the meals besides that of the hours. In the following table the same observer shows the tidal movement of daily oscillations:

Maximum of the evening (4 to 6 o'cl.)........37.49°
Maximum of the morning (9 to 11 o'cl.)......37.26°
Minimum of the evening (8 to 10 o'cl.).......37.05°
Minimum of the morning (5 to 7 o'cl.).......36.31°
Medium of the day (24 hours)...............37.03°

Labbée indicates two daily maxima irrespective of digestion or sleep, therefore tidal too, and thinks that the sum of the tem-

peratures of 10 A.M. and 10 P.M. divided by 2 represents quite correctly the average of the day.

Paul Bert comprises the diurnal oscillations of the temperature of healthy adults in one degree C. and finds the mean daily at 10 A.M.; others place it nearer to 12 A.M.

These discrepancies are attributable to several causes: to the object in view when the observations were taken; to the subjects on which they were taken; in or out of hospital conditions; on chronic or acute patients, etc. All these uncertainties show that, of the human norme, we know the central axis; we know that it has an oscillatory diurnal movement, but we are not agreed as to the extent, times and rhythms of this movement; moreover, we hardly suspect that seasons, atmospheric and sidereal conditions, may have an action on human temperature. How much more to be learned.

In the concrete and in the practice, we must know the norme of all our patients, and make people aware of the importance of knowing their own norme of ustion, of circulation and respiration. The meanest cur lost in the street can answer his name, and the most learned man, if accidentally taken sick, cannot tell a casual practitioner the habits of his vital functions, whose figures must be the basis of an urgent, and sometimes solemn, diagnosis. Therefore let us know more, theoretically and practically, about the norme, the range and rhythm of its oscillations, and next of its abnormalities.

III.—Are there Abnormal Normes?

Displacements of the norme by idiosyncrasy, or in consequence of some accident or affection, are likely not unfrequent, though rarely noted. Thomas expresses the opinion that, as there are persons who naturally have a *slow pulse*—others may have for their individual norme a *low temperature*.

We have seen children born with a sub-norme, some of whom keep it as long as we were enabled to follow them. Roger admits the reality of these displacements, either by idiosyncrasy or from accident, during the first septennat of life.

Wunderlich recorded quite a number of *normal* adult temperatures at 96.8° F.=36° C.=1 (one degree below zero of the physiological scale), in other terms an *abnormal norme;* and he took the observation of a girl, æt. 18, who was said to

have been *cold* from infancy, whose temperature in scarlatina never rose above 38.3°, and since remained at 36.1° C. while he had the opportunity of continuing his observation. Nevertheless he concludes that *idiosyncrasies* show their peculiarity in temperature as in anything physiological, but that observations are too few to draw conclusions.

Let us conclude, on the contrary, that it is a reciprocal duty for physicians to take all the normes they can; and for every man and family to keep their norme (of ustion, circulation, and respiration) as the criterium by which all possible anomalies of health may be foreseen, judged, and eventually cured. The key to the aberrations of combustion is the physiological temperature.

CHAPTER III.

WOMEN'S TEMPERATURE.

We have no more certainty about the comparative degree of women's temperature.

According to the table of Ogle, just quoted, it would be .5° F. higher than men's; about the same according to the calculations of Wunderlich. But Davy found the temperature of male adults .7° F. superior to that of women; Roger—taking care to operate on healthy children—found the temperature of boys superior by .5° C., at the same time that the pulse of girls was more frequent by 7 beats (Roger, confirmed by Trousseau). The tables of Mignot, though bearing also on other points, sustain the latter opinion (see Appendix No. IV.). According to Andral and Gavarret, women produce less *calor* than men, because they are more accessible to causes of cooling, and exhale less carbonic acid through the lungs, etc. Such contradictions among authorities show how much of the work remains to be done.

The temperature of women in relation to their monthly functions, during gestation, delivery, lactation, will be considered with that of the puerperal state.

CHAPTER IV.

INFANTILE TEMPERATURES.

Age, more successfully studied than *sex*, has been shown to displace the norme, and though these displacements rarely exceed one degree (Paul Bert), their figures, ordinarily mere fractions, are important, since from them must be calculated: (*a*) the march of constitutional affections in infancy; (*b*) the modes and degrees of alteration of temperature in disease; (*c*) the restoration of the norme at its starting-point, defervescence and convalescence. These variations by age are:

At birth	37.08°	In youth and virility	37.39°
A few hours after	36.95°	In old age	37.04°
In infancy	37.30°	In senility	37.17°

(See Appendix No. VI.)

The temperature of the fœtus, prematurely born, is lower in proportion to the advance of its birth (Edwards, Nonat).

Meigs and Pepper (in *Diseases of Children*) sum up the observations of Finlayson in this concise manner: "The daily *range* of temperature is greater in healthy children than that recorded in healthy adults, amounting to two degrees F.

"There is invariably a fall of temperature in the evening, amounting to one, two, or three degrees.

"This fall may take place before sleep begins.

"The greatest fall is usually between 7 and 9 P.M. (at least under the conditions of life in hospital).

"The minimum temperature is usually observed at or before 2 A.M.

"Between 2 and 4 A.M. the temperature usually begins to rise, such rise being independent of food being taken.

"The fluctuations between breakfast and tea time are usually trifling in amount.

"There seems to be no very definite relationship between the

frequency of the pulse and respiration and the amount of temperature; the two former functions being subject to many disturbing influences."

Infantile temperature is, from the beginning, subject to so many causes of versatility that few robust men could stand it. Then its changes of type about the seventh day, an inward danger added to the external casualties which make its study dramatic from thence, at least till the seventh year. But above this artistic impression, the humane one suffices to raise our interest to the pitch of devotion.

Let us give a comparatively large place to the "temperature of the first years," if only for the immense loss of life and of the subsequent loss of power mankind sustains by want of knowledge of what the temperature of the young ones ought to be, a knowledge which it is the sacred duty of a physician to possess and to impart to those who trust him in the sanitary management of their families.

We do not know how many children die in this Republic from deleterious temperatures; but, without a string of evidence at hand, we can say: in London 45.5 per 1000 children die in the first month, mostly by want of proper care of their temperature. In France, at large, the first year's loss is 204.2 per 1000, in some departments 308 to 369 per 1000; and from one to five years the average is 34.65 per 1000 (from Bertillon's *Demography*). This successor to Quetelet remarks that, by taking better care of the children of the twenty departments whose mortality is presently the largest, it would be easily reduced, not to the minimum, but to the medium mortality of the other departments, and that this little care would save annually 14,000 children—just the number of the annual births in Alsace and Lorraine; so that, if the physicians of these localities were willing to impart a sound knowledge of thermometry to those who have the charge of breeding children, in twenty years France would be as powerful again as she was before the severance of these provinces. Here, not so many children die from absolute want as in Europe, but from uncontrollable neglect, which is the chief source of loss of *vital-calor* in infancy.

At birth infantile temperature invites comparison with that of the mother, and some of the best observers recorded it. (See Appendix V., *a*.)

The "fœtus in utero" is about .5° C. hotter than the uterus.

Before birth the infant temperature is a little higher than that of the mother's uterus or vagina—a difference which may be accounted for, either by the hypothesis that the muscular efforts of the child to disengage itself raises its temperature, as all labors do; or by the other one, that the unborn being has already its own proper source of heat, and its own means of regulating its temperature. Against the first hypothesis may be noted that if muscular contraction develops heat in the child, it cannot fail to develop heat in the mother likewise, or in a superior degree, since she too works; but which of the two works harder for liberation? . . . .

In favor of the second thermogenic theory may be argued that the egg—and the child in the membrane is yet an egg in the shell—is, towards the end of the incubation, hotter than the hen; so much so, that when she is intelligent, she eventually leaves it to cool a while. Moreover, J. Hunter found under the hen the temperature of the fecundated egg 37.2°, and that of the sterile one 36°; this 1.2° C. testifying that the germ, not the mother, is the focus of heat of the new life.

In children prematurely born, *avortons*, the temperature is lower than the norme in proportion to the shortness of their fœtal existence. 32° C. have been found by Edwards and Nonat. Not so low is that of the child born *after* the natural term, but inferior to the norme by several degrees, owing likely to the want of proper nourishment during this forced internation.

At the timely birth of a healthy child, his temperature will be found sensibly higher than after a few hours of exposure to our atmosphere, always more severe than the watery sphere of the amnion; change by which it readily loses .7°—.8° C.=1.26° —1.44° F., and, if not well provided for, a good deal more.

Nothing is more instructive for the management of infants than the knowledge of these first fluctuations of their temperature. When yet adherent to the cord, be it the effect of fever, pressure, work (as we suggested), or of inward power of heat-production, their temperature attains 37.8°—38.2°, and eventually 39.5°—40° C. But in half an hour to one day it falls even to 35.5°—34.2° C. Generally, after five hours reaction slowly commences, bringing the body to its first norme, 37.5°, through oscillations from 37.2°—37.9°, neglecting accidental motived *ecarts*. (See Appendix No. V.)

The children of 3,000 grammes (6 pounds) and upwards are

those who keep nearer the norme; if lighter, the consequent frigeration comes nearer algidity, with less power of reaction. If this double loss of body-weight and of temperature persevere, they die. This lands us in the middle of an important problem, the double movement of body-heat and body-weight in the new-born. In the first twenty-four hours he may lose 30 to 120 gram. (1—4 oz.); if 160 gram. he is ill. The initial weight comes back the third day, whence the ascension is progressive, with a temperature below 38°.

There is the *Schema* of this movement:

1st day...	loss	60 gram. (2 oz.)	5th day...	augment	70 grams.
2d " ...	"	60 "	6th " ...	"	60 "
3d " ...	augment	60 gram.	7th " ...	"	60 "
4th " ...	"	60 "			

The nearer these figures, the healthier the child. If mother or nurse cannot render a clear account of their charge, by comparing the temperature and the body-weight you can supply their malice or stupidity, and save many children. See Part II., Chapter V., § *c*.

After these stormy events of the first week (see Appendix No. V., *a*) the puerile norme 37.2°—37.5° is established, and the danger of revolutionary temperatures lessened till the seventh year (see Appendix No. VII.), but not suppressed.

One of the difficulties in observing the temperature of babies is its want of regularity. Their life is spent in eating and sleeping without regard to day or night. It is only after the fourth or fifth month that a slight morning and evening *oscillation* begins to be noticeable. In their first weeks, and even months, they are extremely impressible to the causes of *fluctuation* of temperature, which later in life have little action. To this especial sensitiveness are attributable in apparent *health-fluctuations of* .5°—2.6° C.=.9°—3.6° F., *which in adults would be considered as sickly perturbations.*

Even crying will cause a raise of temperature in children. Sleep or no sleep acts on the same function. A light one cools, a protracted one frigerates; the want of it increases the heat; its long privation brings on algidity. Wakefulness in the evening considerably lowers, and sleep harmonizes their temperature; but protracted, it lowers the three great vital functions. A

healthy child awake had temperature (rect.) 99° F., pulse 150, respiration 50; during a deep sleep at noon he had temperature 98.4°, pulse 120, respiration 30.

Babies cool quicker and more by night than adults; they die sooner, too, in algidity from starvation. But without going to extremes, "a depression of temperature in infancy is of more immediate practical significance than the slighter elevations, since it points at once to the want of a better nutrition" (W. Squire, in *Infantile Temperatures*, etc., London, 1869).

Thus what apparently surrounds the baby with danger proves to be the means of saving him, if those in charge only understand the thermometric signs.

We know food to be the main source of heat, and an equality of temperature to depend principally from a regular supply of wholesome food. Therefore we will look towards bad feeding whenever we meet with apyretic temperatures in the young. Two hours when awake, and three when asleep, must elapse after a full meal to influence the temperature of a healthy child. This effect is not so sensible on one uniformly well fed, as on another insufficiently fed and improperly cared for; therefore a sudden elevation of temperature indicates the evil, as per cases reported by Dr. Squire (op. cit.). When a child has suffered from weakness or want, a direct increase of the bodily temperature follows the administration of food. "Case No. 2 not washed, nor fed for some hours; rectal temperature 97.4°; after suckling, 98°. Case No. 3 not suckled for three weeks, thrush, danger of inanition; temperature *in recto* 96°—95°; after two days of breast-milk 97°; third day 98.8°, an increase of a whole degree in twenty-four hours, besides other signs of returning health."

In well children, food or warm drink will sooner heat the surface than increase the central temperature. Cold bathing acts the same. When the circulation is feeble, and there is fatigue and chillness, warm food and bath rise both, internal and external temperatures: almost two degrees may be gained by this double method of applying heat. We have not here in view any medical treatment, simply the uniform preservation of the norme.

On this point, as on several others, we feel that we cannot do full justice to the subject of *infantile temperature in health*,

but can only refer to the Part Second already referred to, and to Appendixes V. (*a*, *b*) and VII., on the very important *relations of temperatures to pulse and respiration.* But we will sum up our interest—the interest that every physician certainly feels in this subject—by the memento of Hufeland: "Remember! . . . . two-thirds of the sick are children." Adding: "Deviation from the norme of temperature is often the only warning of their danger."

CHAPTER V.

THERMAL INFLUENCES ON THE NORME.

a.—Of Food.—Nutritious materials introduced into the body, though chief means of warmth-production, hardly affect the temperature, because the excess of heat produced is disposed of. The breakfast raises the temperature more than the lunch, and the evening dinner causes simply a delay in the fall, which otherwise takes place at this time of the day. Generally the effect of a meal on temperature is slight, unless the individual is unwell or the food unhealthy. (See Appendix VI.)

Of Drinks.—The transient effect of a moderate and habitual use of ardent spirits and other drinks on the temperature of the healthy are thus resumed. Two pints or so (a mass) of beer lower the temperature of .5° C.=.9° F. in fifteen minutes. Wine and brandy lower the temperature too. In full doses brandy lowers the fever heat by fully two degrees, and gives the pulse fulness and frequency. Warm alcoholic drinks elevate the temperature; also coffee and tea; carbonic acid drinks lower it for a short time.

The effects of drinking cold water (Lichtenfels and Fröhlich) was to lower the temperature; and that of immersing one hand in very cold water was to lower its temperature 8°—18° C.=14°—34° F. in a few minutes; did not alter the general temperature, but lowered that of the other hand as soon as the immersed hand became painfully affected by the cold (Brown-Séquard and Tolozan, *Journal de Physiologie*, i. 497).

But as the action of food, alcohol, wines, water, etc., extends farther than the mere preservation of the norme—to its restoration, for instance—we will put off further remarks till we speak of them as therapeutic agents.

Cold bathing, in good ordinary conditions, equalizes the temperature, and comes next to food—with food, must we say? —as a factor of the norme with a weak circulation, fatigue or

chill, the bath, like the food and drink, must be warm, and yet not so hot as to promote hyperpyretic temperatures.

The possibility of frigeration by cold water is more marked in those born before their term, and next in those born after their term. Then old people frigerate easier than adults, though when well their actual temperature does not differ from that of adults, because if they produce less heat, they lose less too, from diminished perspiration, pulmonary exhalation, etc.

The thermal influences are modified by the nature of the agents, air, water, etc., which bring heat or cold in contact with us. They are also modified by their duration. Thus the immediate effect of cold is to abstract blood and to cool, as that of a higher temperature is to heat and prevent cooling. But every diminution or elevation of temperature which occurs through short thermal agencies is transient, and followed by a reaction; so a high temperature of the body commonly follows a cold bath, and after a warm bath the body feels cooler.

But how can these often delicate influences be appreciated, particularly in children? By the thermometer, which, instead of standing at the window "pour voir si le printemps s'avance," must be applied to the child by the mother, to detect any threatening temperature, and indicate its cause. But to say more on this subject, as on the preceding one, would interfere with thermo-therapeutics.

b.—Latitudes.—The most comprehensive word for location, climate, seasons, etc., acts on the body's temperature in several ways. By sudden exposure it causes fluctuations, soon followed by reaction; by extreme transitions it raises the temperature in a more marked and permanent degree; yet by continuing in the same *latitude* it produces *accoutumance*, which may confirm or displace the former norme (besides producing other effects on the constitution). These apparent contradictions are rendered sensible by the examples of climatic actions on the body-temperature chosen by Wunderlich:—The "transition from a hot to a cold climate" (John Davy) lowered the temperature .88° C.=1.58° F., whilst the transition from France (temperate) to Mauritius (hot) gave to Brown-Séquard the following results on eight healthy persons, between the age of seventeen and fifty-five. With the thermometer under the tongue, the atmospheric temperature at 8° C.= 56.4° F., he obtained a mean body temperature of 36.625° C.=97.9° F. Eight days later,

with the temperature of the air at 25° C.=77° F., a mean body temperature of 37.428° C.=99.4° F., and nine days later, under the equator, with an atmospheric temperature of 29.5° C.=85.1° F., a mean body temperature of 37.9° C.=100.21° F. But six weeks later on the voyage, in 37.4° latitude, with the external air at 16° C.=60.8° F., the mean body temperature had sunk to 37.25° C.=99.04° F. (*Journal de Physiologie*, ii. 551). Livingstone (*Travels in South Africa*, p. 509) found the temperatnre of the natives 1.8° C=2 F. less than his own; and Thomson that of the Faroe Islanders somewhat higher than our norme, 37.2° C.=98.96° F. under the tongue.

Davy and Brown-Séquard had noted temperatures *in transitu*. Livingstone compared the *transient* effect of the high climate of Africa on himself with its *permanent* effect on the indigenous; instead of which Thomson compares the temperature of the Faroe Islanders—not to his own, which was likely displaced by the transition—but to the accepted norme of Europeans. When the premises differ, the conclusions cannot agree. However, the action of climate on man is so limited that it affects his temperature only one-tenth of a degree from winter to summer, and not much above one degree from the equator to the polar regions.

c.—How much more *altitude* acts upon our body-temperature; not by tenths of a degree during long journeys, but by many degrees during a single ascension of a few hours.

It primarily affects the respiratory functions, and through them the circulation and the calorification, but more in walking or working than at rest. During transient ascensions the temperature fluctuates when descending below the norme. During a protracted sojourn on the uplands, the norme may become displaced; in which case the pendulum of the oscillations continues its diurnal movement around this new centre, with or without other constitutional changes following the "accoutumance." *En somme* the compression of air increases our temperature, its rarefaction lowers it with mathematical precision.

Three forms of experience have concurred in throwing new lights on this subject: Paul Bert's "*On the influence which barometric pressure-changes exercise on the phenomena of life;*" the aerial ascensions of Sivel, Glaisher, and others, and the terrestrial ascensions of Leurtet, etc. (see Appendix VIII.).

These experiments concur in the demonstration of facts actually available in physics and in homoculture.

The inhalation of *oxygen* in definite proportions, tested by Bert, permits to undertake the exploration of the highest points of our globe, hitherto inaccessible, and to push on with less danger the submarine and subterranean works of engineering.

In medicine the combined action of oxygen and altitude upon human temperature in many ill conditions, but particularly in lung troubles, is so precise that we now can prescribe with more confidence the sojourn in or the passage through certain altitudes, to mathematically lower or raise pathological temperatures, than a physic for purging.

By showing where birds begin to be asphyxiated, Bert taught us where the consumptive can breathe and live.

As for education, by introducing in it more of the action of altitudes, longitudes, oxygen, insolation, mathematically dosed, we may expect to raise homoculture as high in positivism as horticulture. We already know, for instance, that from Vera Cruz to Mexico the graduated altitudes and climates are like so many step-mothers and fathers to the vegetable produces of the whole world; but we hardly yet suspect that on each of these terraces the most beautiful and esculent crops of humanity could be raised, which die under the atmospheric pressures of New York, Paris, London, in the poisoned air of upas-like crowds; this is the object of the oldest and newest science, mesotherapy. (See Part II., Chap. VI., § *c*.)

d.—The influence of *muscular activity* upon the body-temperature has been ascertained by Becquerel and Brechet, who found that when a muscle contracts, its temperature rises at first half a degree, soon one degree and more. The heat thus generated appears greater when the available force produced is not employed; and smaller in proportion as some part of it has been converted into labor. These thermometric results are thus explained: Setting aside the normal heat (37° C.) generated and spent for the mere purpose of feeding life, the *surplus* generated by muscular contraction is found, partly in a transient elevation of temperature, whose quantity will soon be exhaled through the skin, lungs, etc., and partly in the mechanical results of labor; the sum of both being the equivalent or the results of the chemical action evolved from the muscles.

Hirn, while at rest, produced 155 heat-units, *Calories*, and whilst working at a treadmill, 251; and yet his temperature was not higher; because at rest the heat is not liberated, whilst at work, though produced in greater abundance, it passes off by more rapid breathing, quicker circulation, sweating, etc., besides the part converted through movement in labors by its factor activity; so that, though more heat-units are produced, more are evolved, and the final difference of temperature during rest and during labor is trifling. (Excesses reserved.) This is what interests mostly the dynamist and economist, from their point of view, the quantity of work exactable from a man or a people.

Physicians are interested in the same problem from a different point of view—that of the durability and reproduction of the self-contracting machine, man.

Restricting our duty in this matter as much as possible, we feel an immediate interest in the variations of temperature—even transitory, but frequently recurring—which have their motor origin in muscular contraction, and their secondary cause in either imperfect aeration and nutrition, or in an excess of expense of calories. Without this knowledge, we would ignore if nature has yet—or has no more—resources available to concur with us in the restoration of the *norme.*

In this investigation we find these variations of temperature resulting from muscular contraction of two kinds—though possibly differing only in degrees—but let us say *kinds*, in consideration of the difference *in kind* of their results. The first kind of *variations* are those which can be considered as simple exaggerations of the normal oscillations. Their characters are: mathematically, their diurnal ecarts are greater than those of repose, but they return to the norme; and physiologically, far from being accompanied by exhaustion and suffering, they make rest and work alternately more enjoyable.

The other *fluctuations* of temperature, produces of excess of muscular contraction (or of mental sur-activity as well) are recognizable, mathematically, sometimes by larger, always by more lasting ecarts, and are followed by (slight at first, and finally permanent) *displacements of the norme.* Their physiological test is the absence of rest and re-invigoration after using sleep, food, bath, and other usual restorative processes.

At this stage of deperdition of caloric man falls a prey to any cause of enfeeblement and extinction; excessive conversion of

calories in labor will exhaust, not only him, but his race. Gavarret demonstrates that if the working-man spend more heat that his heating apparatus, wholesome food, pure air, etc., can furnish, sooner or later his central temperature will descend below the norme, and he will be left without reaction against any new cause of drainage of calories.

Therefore, whoever appropriates to himself the equivalent in produces of this sacred 37° C., the norme upon which every one, without exception, ought to live, eats up in fractional equivalents the thermal substance—calories—of his fellow women and men. With this difference, however, that the direct anthropophagist is contented with a few pounds of human flesh, but the civilized anthropophagist consumes day and night thousands of calories which are others' life. I would not have insisted on this fact if Wunderlich had not said: "No well observed facts tend to establish a difference of temperature between the rich and the poor, nor on account of difference of occupation." But, besides Gavarret, Roger has shown that scleremic children owe their algidity to the conditions of excessive work, privations and sufferings of their parents; and Manouvriez, in his *Rapport sur les épidémies et endémies d'anemie dés mineurs d'Anzin de* 1803 *à* 1875, has shown to what fearful degenerescences are condemned those who work above their strength, away from the heat and light of the sun, to enrich, with the red corpuscles of their own blood, the blood of the gamblers in stock, etc.

Not only the overworked man has his own norme displaced —higher or lower according as the strain affects his expense of calories or his calorigenic capacity—but the diseases of his family will all bear the stamp of apyrexy and anæmia, sclerema, thrush, croup, cholera infantum, etc. Later, the heir to the rich (if spared the virus of vice) will have a more even temperature from the centre to the periphery, from youth to old age, whilst the new crops of working humanity will be shorter lived, shorter sized, deformed like the canuts of Lyons, and show in their discolored skin the inheritance of a low peripheric circulation and temperature.

e.—The influence of *intellectual activity* and mental labor upon temperature does not seem to differ in kind, in mechanism, and in degrees from that of muscular activity. Brain-work increases the produces of oxidation (urea, etc.), and therefore oxidation itself; so say chemical analyses. It also elevates the

central and cephalic temperatures, as shown by general and localized thermometry.

This conclusion results from the experiments of John Davy, showing also that brain-work is attended with a higher rise of temperature under the tropics than in northern latitudes; and from those of J. S. Lombard, proving that anything which excites attention causes a slight rise (like .1° C.), and true brain-work a much higher one.

Moreover, Brown-Séquard was enabled by an extensive use of surface-thermometers to support, with figures, the theory affirmed under the questioning form in his celebrated paper read in 1873 before the Smithsonian Institute, *Have we two brains?* showing that the thinking brain—ordinarily the left—has a higher temperature than the right one; just as the right hand is more active, and less subject to paralysis, having a more even temperature than the left lazy one.

Here again we must be prepared to discriminate the *fluctuations* which are only *oscillations* of temperature, temporarily exaggerated by a legitimate and well-supported activity, from those which have lost their rhythm, and their centre of gravity, under the double pressure of sur-excitement and exhaustion. The former make the scholars, and produce valuable ideas and chef-d'œuvres; the other develop in children granular meningitis of the base, produce in adults several intellectual incapacities, and if persevered in, national or class degenerescences.

f.—Moral Strain.—After all, as the great keeper of the norme of the body-temperature, and of its healthy oscillations, is an equally balanced action of the sympathetic over all the functions, it was to be expected that the causes of perturbation of this sensitive apparel, like the tension caused by incessant apprehensions, or the stunning shock of unexpected issues, would affect the body-temperature in the scheming classes, as does the loss or paucity of calories in working people. Here hyperæmiæ are the factors of frequent hyperpyrexiæ, over which the sympathetic loses, by suddenness or repetition, its regulating power. General, spinal, and cephalic anæmia and apyrexy follow, which paralyze, or sent the schemer and the wife who partakes of his emotions where, happily, the maniac does not recognize the demented. A large percentage of their children are born with soft bones or soft brains, bound for rachitism, idiocy, epilepsy, hemicrany, etc.

Morally, the keeping of the norme is the reward of an honest, independent, useful life, during which the fluctuations of temperature in health are but slight; if they rise quickly they go down as quickly; a great increase of warmth is accompanied by a larger loss; a small production of heat is balanced by a slight deperdition. Herein is the mystery of organism: in health, calorification and decalorification compensate each other with a wonderful regularity; accidental disturbances are immediately brought back to the rule; disease will present the opposite phenomena of strong, lasting perturbations from the norme.

Thus we have brought human temperature from its norme to its abnormalities, whose study follows.

CHAPTER VI.

PATHOLOGICAL TEMPERATURES.

All abnormal temperatures denote a disease, but all diseases do not show an abnormal temperature.

Is it because only in certain diseases the temperature (*calor*) becomes involved? Not likely; sooner because our means of calorimetry are so imperfect that many forms of thermal aberrations escape their sensitiveness. Simple pyrexy and apyrexy are easily noted, but not so those perturbations of temperature which consist in a conflict for the central and peripheric repartition of caloric, or between its local means of keep or escape. Remember the struggles of combustion in a boil; or have you ever studied the temperature over and around a cold abscess? To perceive the more delicate or hidden of these *ustions*, our instruments are completely inadequate, or, like the thermoscope, hardly yet invented. (See Part II., Chap. II., § VIII.)

Other diseases, whose temperature is little known, are those in which, without being positively or permanently abnormal, it is discordant with the other vital functions. These discordances are the object of some further remarks, but have never been thoroughly explored. They cover a large pathological ground, which, with the other ones just pointed out, form a vast *terra incognita.* (See Part II., Chap. V., § 1.)

For this and many other urgent reasons, a knowledge of the course of temperature in disease is indispensable to medical practitioners.

Because: all the phenomena of the sick are deserving of study. The temperature may be determined with a nicety which is common to few other phenomena. The temperature can neither be feigned nor falsified. We may conclude the presence of some disturbance in the economy from the mere fact of altered temperature. Certain degrees indicate

that there is fever. The height of the temperature often decides both the degree and the danger of the attack. Thermometric observation may aid in the discovery of the laws regulating the course of certain diseases. When once the normal course of certain diseases has been determined, thermometry is able to simplify and confirm the diagnosis. Thermometric investigations indicate rapidly and surely any deviation from the regular course of a disease. The behavior of the temperature during the progress of the disease discovers either relapses or ameliorations before they could be otherwise recognized. In this way thermometry is able to regulate therapeutics. It puts us on our guard against any injurious influence that may affect the patients in the course of their illness. It serves to indicate the transition from one stage of the disease into another, and particularly the commencement of convalescence and its complete establishment. It reveals complications, and how far recovery is from being complete. It generally reveals the imminence of a fatal termination. It announces the impossibility of the continuance of life. It furnishes certain proofs of the reality of death, when this is otherwise uncertain.

The application of thermometry to surgery answers already its most pressing questions. At what temperatures operations are possible or would be fatal? When do accidents threaten under natural or dressing occlusions? How to use, and when not, the anæsthetics, single or combined? The answers have been peremptory; proving to the surgeon that, with him, the thermometer must take precedence of the knife: temperature has become the beacon of surgery.

Lastly, one may say that there is no physiology possible without thermometry.

But this knowledge of temperature must not be kept an arcanum among the profession, since it is wanted wherever, the physician not being present, it is interesting to know that heat is evolved faster than it can be generated, or *vice versâ.*

Laities begin to understand that their temperature is their physiological soul. For them, inquiries about body-temperature in all matters of work, enterprise, education, have lost their strangeness; mothers, nurses, teachers, leaders of men, begin to feel that what they exact in the form of handy-work, exercise,

attention, memory, judgment, determination, is body-heat, exhaustible by an imprudent husbanding.

So that three orders of facts render it necessary to study the body-temperature: medical, surgical, and social facts. But keeping ourselves, for the present, in the limits of physic, we say that three facts render it necessary for the physician to take a thorough knowledge of the body-temperature: its invariability in healthy persons, its mobility in the delicate and during exertions, its perturbations in the sick, over-worked and ill-fed.

CHAPTER VII.

PRINCIPLES

BY WHICH TO JUDGE OF THE SIGNIFICANCE OF THE TEMPERATURE-CHANGES.

A NORMAL temperature does not necessarily indicate health, but all those whose temperature varies on slight causes may be considered as easy preys to disease or to decay; and those whose temperature exceeds or falls short of the normal range are actually on the way towards, in, or out of sickness.

The axillary temperature of 98.6° F.=37° C.=0 of the physiological scale (see Appendix I.), is considered the central thermic point of health, the axis of thermometric calculations.

The ordinary range of pathological temperatures is between 95° F.=35° C.=$\overline{2}$ Ph. and 108.5° F.=42.5°=$\underline{5.5}$ Ph., and very seldom falls below 33° C. or rises to 43° C.

However, Henri Roger discovered in children falls to 22° C., and Wunderlich in tetanus a terminal 45° C. Barring these and other more recently discovered rarities, the ordinary pathological *ecarts* from the norme (0 Ph.=37° C.=98.5° F.) cover $\overline{2}$ below and $\underline{5.5}$ above the norme; altogether a range of 7.5° C. of the physiological and centigrade scales.

Such are the usual proportions of the stage on which the drama of our life is played in, and out.

Deviations from the normal course of temperature never occur without causes or fixed laws; that is the foundation of Pathological Thermometry. We sometimes fail to discover these laws, because in disease, more than in health, the temperature of the body is the result of mutually antagonistic factors.

Influences which in no way disturb the temperature of the healthy, derange that of the sick, even if they hardly affect his sickness. Mobility of temperature under the action of external influences is, therefore, a sign of some diseased condition of the

body. It is so that the discovery of abnormal temperatures in men previously healthy becomes a means of discovering or confirming the existence of a latent disease.

Alterations of temperatures may be confined to special regions, whilst the rest of the body remains almost normal; they seldom exceed 1° C.=1.8—2° F.; but are accompanied by other obvious phenomena sometimes more useful for the diagnosis than the local abnormality of temperature.

Since Wunderlich wrote this, the use of the surface-thermometers has modified these conclusions, by demonstrating larger differences between local temperatures, and between the central and the peripheric.

The use of the thermoscope will render these differences more sensible, and lead to the creation of a localized thermometry.

The general temperature is the *expression* of several processes, some tending to the production of heat, others to its exhalation. However varied is the combination of these processes, their thermal result, or the specific heat of the body, remains the same in health; and its variations in disease, though not absolutely trustworthy, are yet the safest standard by which to estimate the condition of the whole body. Variations of temperature coincide with other functional and structural disturbances not so easy to measure, and often appear long before other morbid alterations can be recognized.

The heat of the whole body may be normal, increased or diminished, whilst that of separate regions is different. *A normal temperature in sickness is only a relative sign*, which may exclude certain forms of disease, but cannot by itself found a sure diagnosis. *A fall of temperature below the normal range* occurs temporarily, favorable or not. *An unequal distribution of animal heat* is unfavorable. *Abnormal deviations* furnish the best elements of diagnosis and prognosis.

Certain abnormal temperatures are generally associated with a type of ill-health. A rapid increase in the heat of the body, and decrease of the heat of the extremities, is associated with *cold shivers*, *rigors*, *fever-frost*. A protracted temperature of 38.5° C.=101.3° F., or more, is usually accompanied with heat, lassitude, thirst, headache, frequency of pulse; if persisting with diminution of body-weight, *pyrexia*, *fever*, *fever-heat*. Any considerable diminution of warmth in the extremities,

with very high or very low central temperature, is expressed by a small pulse, sunken features, weakness, nausea, cold sweating, collapse.

The *amount* of temperature-changes, their *relation* to one another, and their subsequent *alterations*, are commonly determined by the course of the disease; so that the more typical the disease, the more typical is the alteration of temperature. In opposition to these types are the atypical diseases in which the temperature, too, is irregular. Between them stand the affections, whose types and temperatures are not sharply defined.

The typical diseases, which hardly deviate from their type, are illustrated by typhoid fever, typhus; and apparently by relapsing fever, small-pox, measles, scarlatina, lobar pneumonia, and recent malarious fevers.

The approximately typical diseases, which exhibit great regularity in certain stages, and none in others, are exemplified by febricula, pyæmia, septicæmia, varicella, rubeola, facial erysipelas, acute catarrhal inflammation, tonsillitis, acute rheumatism, basilar meningitis, meningitis of the convexity, cerebro-spinal meningitis, parotitis (mumps), pleurisy, acute tuberculosis, fatal neuroses in their last stage, and trichinosis.

Another group is formed by those diseases which generally run their course without fever, but which display a regular type whenever fever supervenes. To this group belong cholera, acute phosphorus-poisoning, acute fatty degeneration, and syphilis. Even diseases designated as atypical exceptionally show an approximation to some type, as diphtheria, dysentery, pericarditis, peritonitis, acute and chronic suppurations (abscesses), and phthisis.

A temperature is *monotypic* or uniform, as a rule; but in special cases it becomes *pleotypic*, or multiform. Thermometry finds out these variations, which have enabled us to differentiate various types in the same disease. Thus, small-pox, typhoid fever, scarlatina, pneumonia, and malarious fever may assume the pleotypism that thermometry alone can demonstrate.

Any disease, however fixed may be its type, may exhibit deviations from it (irregularities). These irregularities are circumscribed and determinate; thermometry alone can assign their extent and their form, and predict the time when the irregular course will reassume the typical form.

A single observation of an abnormal temperature (however great or small may be the deviation from the norme) is not by itself conclusive as to the kind of disease present. All we learn from it is this: That the patient is really ill. When there is considerable elevation of temperature, we know there is fever. With extremes of temperatures, we know there is great danger.

This is the *abstract significance* of a single observation.

Temperatures much below 36° C. = 96.8° F., are *collapse-temperatures.* Below 33.5° C.=92.13° F., deep, fatal algide collapse; 33.5°—35° C.=92.3°—95° F., algide collapse with great danger, still with possibility of recovery; 35°—36° C.= 95°—96.8° F., moderate collapse, in itself without danger.

Normal or almost normal temperature: 36°—36.5° C.= 96.8°—97.7° F., sub-normal temperatures; 36.6°—37.4° C.= 97.88°—99.12° F., really normal temperatures; 37° C.= 98.6° F., the NORME; 37.5°—38° C.=99.5°—100.4° F., sub-febrile temperatures.

Febrile temperatures: 38°—38.4° C.=100.4°—101.12° F., slight febrile action; 38.5°—39° C.=101.3°—102.2° F., in the morning, rising to 39.5° C.=103.1° F., in the evening, moderate fever; 39.5° C.=103.1° F., in the morning, and above 40° C.=104° F., in the evening, considerable fever; 39.5° C.=103.1° F., in the morning, and above 40.5° C.= 104.9° F., in the evening, high fever.

Hyperpyretic temperatures: 42° C.=107.6° F., and above, indicates a fatal termination, except in relapsing fever and other rare conditions.

A single observation of temperature (corroborated by other symptoms) may sometimes lead to a diagnosis or exclude another, or determine the severity or the innocuity of an attack.

There are variations of temperature in the course of twenty-four hours in health; so in disease, only greater. These variations, in febrile diseases, are subject to rules dependent on the kind, severity, and stage; upon them depends improvement or crises. If the daily temperature of a patient deviates from its pathological type, the cause of it must be looked for in circumstances, complications with diseases of another or no type, sudden relapse, constipation, diarrhœa, sudden emptying of a distended bladder, spontaneous or therapeutic loss of blood, pro-

fuse perspirations, moving, fatigue, mental excitement, wakefulness, error of diet, thermal influences, or the operation of medicines and other therapeutic agencies.

The daily fluctuations may be either simply ascending or descending. They almost always describe a *course* composed of one or more *elevations* of temperature; daily *exacerbations*, and intercurrent *falls* of temperature; daily *remissions*. The number of degrees (extent of the *ecart* or *excursus*) between the daily *maximum* and *minimum* is the daily *difference* or *range*. When the *difference* is trifling the temperature is called *continuous;* when considerable, *remitting*. The *mean* or *medium* between the maximum and minimum is the *average* daily temperature; and its *height* shows the intensity of the fever. Typical forms of diseases have during their intensity a determinate average temperature, and seldom sink below or rise above their minima and maxima, unless shortly before death.

Continued thermometric observations during a disease marked by high temperature afford the best materials for diagnosis and prognosis. They show us what is *conformable to law* or *normal* in the course of a disease, and often form *a correct example of a kind of disease* (type). They mark distinctly the *stages* of a disease, even their mode of *transition;* they afford the best means of judging the severity of a case, its ameliorations, exacerbations, irregularities, relapses, restoration to health, imperfect recovery, and tendency to a fatal termination, besides controlling the entire treatment.

In the course of febrile diseases we may distinguish the following stages or periods in the range of temperature.

Periods preceding the termination of a disease. The *prodromic*, of which we know so little.

The initial or *pyrogenic* stage, longer or shorter, is considered closed by the development of a *localized process*, or when the lowest daily average *characteristic* of the disease is reached. The *acme* or *fastigium*, during which the fever maintains its characteristic daily temperature. The *amphibolic* stage (perturbation in some severe diseases), whose temperature is irregular.

Periods in case of recovery:

The *crisis*, *perturbatio critica*, is the first stage of *decrement*. The period of return to normal temperatures: stage of *deferves-*

cence or cooling. The *epicritical* and convalescent period, in which the temperature is normal or a little above or below.

Periods of the fatal termination :

The *pro-agonic* period, preceding the death struggle, whose temperatures are varied, but more or less characteristic. The *agony*, or death-struggle. The *act of dying*, and the post-mortem changes of temperature. (These last stages may be so brief and contracted as to escape observation.)

Reviewing these periods separately :

The *prodromic periods*, hardly yet studied, must be found out.

The *initial period* has often a characteristic type, but commonly escapes observation ; it is varied by the morbid local processes which may accompany the fever. The patients previously ill and feverish, the type of the stage preceding the new attack is very vague. The intensity of the symptoms (temperature, etc.) in this period can found a diagnosis only when exceptionally severe.

The next period, or *fastigium*, affords characteristic data for a *correct diagnosis* in three ways : from the height of the temperature, from its successive alterations, from the duration of this stage. By the elevation of temperature, its continuance at abnormal heights, and its deviations from the normal type, we learn the intensity and degree of danger of a disease. On the other hand, when the elevation of temperature is moderate, the duration of the maxima short, and the remissions early, we judge that the disease is of a mild type. Irregularities in the course of the temperature, even when they indicate an abatement of fever, are favorable only in special cases. *A rise of temperature towards the end of this stage generally betokens some complication.*

The *amphibolic* stage is generally present in severe and in fatal cases. It is more plainly recognized after a regular fastigium. Its complications are ushered in by noticeable elevations of temperature. As long as it lasts, days or weeks, we must be guarded in our prognosis. In it, a single very high or very low temperature is less significant than a steady one ; a steady abnormal height threatens with relapse ; moderately elevated, it renders convalescence probable.

At the conclusion of either the fastigium or the amphibolic period there is commonly a *final rise of temperature*, associated with other critical symptoms, *perturbatio critica*, of which

the character, very uncertain, can be judged by the further course.

The stage of *decrement*, or period of preparatory moderation, is wanting in many cases of recovery. The first failure of the temperature to reach its previous elevation, either at the evening exacerbation, or in the morning remission, is the characteristic of this stage: it may fall in a single sudden descent as low as 36.5° C.=97.7° F., once or oftener, with or without collapse.

The period of *defervescence* or cooling may directly follow the fastigium, or be separated from it by an amphibolic period, a perturbatio critica, and a decrement stage. It is a return to the norme, and has two different types, taking place in from twelve to thirty-six hours by a rapid *crisis;* or gradually, the process of occupying several days, by *lysis*. The march of the defervescence may be by a continuous fall, which, however, when it lasts more than twelve hours, is less marked in the afternoon; or by a remittent fall, which is interrupted by evening exacerbations; collapse may supervene and protract the recovery.

A rapid and regular defervescence is followed by a clearly defined *epicritical period*, in which the temperature returns to normal through increased mobility and a sort of fickleness. Isolated and apparently causeless rises of 2°—3° C.=4°—6° F., relapses and secondary affections show themselves in this period, whose illimited duration merges in true convalescence.

In *convalescence*, or recovery, the disease having left no sequelæ, the temperature is much the same as in health; if it is not, or ceases to be so, sudden elevations indicate fresh complications; continuous elevations, a residuum of the original disease. Protracted subnormal have to be watched.

In cases which terminate fatally, some signs of the approaching end appear in the fastigium or in the succeeding periods, among others a great irregularity of the temperature.

During the *agony* or death-struggle, the temperature alters but little, remains where it was, sinks considerably, or rises enormously, according to the previous generation and evolution of heat.

At the *moment of death* the temperature may fall, but if it was rising *before*, it may continue to rise *in* death and *after* death. In the former case the cooling is rapid, in the latter it

is tedious, and corpses have been warmer than healthy men twelve hours after the cessation of life.

In reviewing the course of *febrile disease*, we find that its duration and succession constitute five principal groups.

Fevers running a short course: febricula ephemera and terminal fevers.

Fevers which exhibit slight daily differences of temperature during their acme, and defervesce rapidly by crisis: continuous fever.

Acute fevers with a remittent course or character, whose middle periods are marked by considerable daily differences between the evening exacerbations and morning remissions, and whose defervescence is also remitting and by lysis. (Extreme and deadly cases reserved.)

The intermitting and relapsing types of fevers.

Chronic and protracted febrile affections, extending over several weeks or months; type remittent, intermittent, continuous, or interrupted by considerable intervals free from fever.

In febriculæ the temperature may rise, with or without rigors, to 40°—40.5° C.=104°—104.9° F., seldom exceeding it; fall in a short unbroken line; last from a half-day to three. It is seen in traumatic fever, brief child-bed, the ephemera or weed of Ramsbotham, during the convalescence of slight catarrhs, etc.; the *paroxysm* of intermittent fever assumes this type. Another type of it rises little and slowly, and either returns to the normal temperature in one or two days, or gradually rises again to 40° C.=104° F., its culmination, then rapidly defervescing; it happens in the same diseases as the former, but in intermittent.

Fevers which terminate a disease, terminal fevers, resemble the preceding, though widely different in their significance. In the period of apyretic diseases which precede death, or in the death-struggle itself, there is a rapid elevation of temperature at the point of culmination; or after a slight fall, during the last moments, death ensues: this form is found at the conclusion of fatal neuroses, and in many cases of poisoning where the temperature may rise above that during life.

Fevers with a *continued elevation* of temperature usually begin suddenly, with rigors and shivering. During the fastigium the average temperature fluctuates, according to severity, between 39°—40° C.=102.2—104° F., seldom more or less.

The difference between the daily minima and maxima is .5°—1° C.=.9°—1.8° F., rarely more. Defervescence is tolerably rapid. This group is represented (but not always) in simple lobar pneumonia, in the eruptive fever of small-pox, in scarlatina (whose defervescence is less rapid), in cynanche tonsillaris, in meningitis of the convexity, in typhus (where the fever lasts longer), in the beginning of facial erysipelas, and frequently in intense fevers, which, at first remittent, pass to the continuous type with an increase of the temperature.

In fevers with *a remittent course*, the initial period may be short or protracted. The average daily temperature varies from 38.5°—40.5° C.=101.3°—104.9° F., or more, because slight and severe diseases affect this type. It may last several weeks, defervescing by lysis. Typhoid fever is the best representative of this group, in which enter the catarrhal affections, influenza, catarrhal pneumonia, febrile rheumatic affections, measles, the commencement of basilar meningitis, acute tuberculosis, acute phthisis, and trichinosis.

In *intermittent and relapsing types*, during the intervals of the paroxysms there are normal temperatures. For the *intermittent* the paroxysms are always short, seldom extending to a whole day; the temperature is higher than in any other disease of similar intensity, with similar absence of danger; 41°—41.5° C.=105.8°—106.7° are common and passed by several tenths. The apyrexiæ are also short, from a few hours to three days; paroxysms and intermissions alternate with more or less regularity; that is the feature, hence the name of that fever.

In the *relapsing* the paroxysm is less limited, the temperature more variable, the intermissions longer, the *relapse* or characteristic repetition happens once only or twice, and more rarely a succession of times.

Malarial fever (ague) is the best example of the intermittent type, whilst *relapsing fever*, "*fièvre à rechute*" of the French, is the best representative of the recurrent form. But many diseases approximate, with more or less regularity, one or the other of these types, especially pyæmia, erysipelas, true small-pox, many cases of true pneumonia, and not unfrequently acute tuberculosis, basilar meningitis, and acute phthisis.

Chronic diseases, and those marked by *hectic*, are of long duration, and their fever may persist for years. Their course, seldom irregular, approaches some definite type, and may change

it for another in time. Their type is usually remittent, with one or two daily exacerbations, some slight, some severe; so that the temperature reaches once or twice its maximum and falls as many times to the normal or below it. There may be a tertian or other rhythm, characterized by intervals of days left between the exacerbations. When complications come, or death approaches, the remitting type often changes into a continuous one, as in chronic inflammations of the lungs, chronic ulcerations of the bowels, etc.

An *elevated temperature* (be its cause what it may) has by itself an influence on the functions of the body, on the nutrition of the tissues, and upon secretions. When it is only slightly raised we cannot appreciate its action on the system; but when it is, and remains considerable, the most evident effect is a diminution of the weight of the body; besides, the pulse and respiration are accelerated, the brain exhibits functional disturbances, the secretions of the skin and the elimination of urea increase, and there is a tendency to local congestions, fatty degenerations, or even destruction of tissues. Yet these disorders do not elicit any proportion with that of the loss of caloric; and though the continuance of life is incompatible with certain elevations of temperature, we know not why, unless heat is life itself.

Very sudden alterations of temperature may influence the functions; rapid rises, especially when the warmth of the trunk considerably exceeds that of the extremities, are commonly associated with *rigors;* with rapid falls, succeeding previous height, then appear dyspnœa, delirium, signs of collapse, etc.

Diseases which, instead of elevated temperatures, have abnormally low ones, never conform to rules as regards their pyrogenic course; inanition, sclerema, cancer, chronic intoxication, some mental diseases, etc.

Exceedingly low temperatures are, however, frequent (but intercurrent) in: the remissions of intermittent fever, in consequence of loss of blood or of powerful evacuations, in excessive defervescence, and sometimes in the death-struggle.

Abnormally low temperatures may disturb the functions, and lower yet render the continuance of life impossible.

Let us now inquire into the causes of abnormality of the body's heat.

CHAPTER VIII.

CAUSES OF ALTERED TEMPERATURE.

Thermometric observations show how *narrow are the limits between health and disease*, and how imperceptibly one passes into the other. Just so with the causes which determine the alterations of temperature.

There are some influences which are nearly certain to produce morbid changes of temperatures; but one and the same influence may induce very different, even opposite effects. The common basis of the operations of these influences does not depend so much on the increase or loss of heat, as on the imperfection of its regulating power. This regulating power, or equilibrium-factor, compensates the actions of the functions on which depends the temperature. Increased production of heat, or diminished loss of it, or increased giving off of warmth, or diminished warmth-production, may act separately or together, in the entire body, or in some part of it, to destroy the balance of temperature, or to simply hinder the action of the regulating power. So, too, in sickness there is a *plus* and *minus* production and evolution of heat, *fresh sources of caloric* unknown to the healthy body, and besides there are new ways of *getting rid of heat.* Among the new sources of heat-production are more *rapid destruction of the tissues* by chemical process, the *formation of abnormal products* of the metamorphosis of the tissues, and possibly the development of some fermentative element, as a new source of heat, as in zymotic diseases. Of the modes of obstructing heat we mention, copious losses of fluids and deposits of almost devitalized masses by exudation. For even when the normal equilibrium is disturbed in disease, a sort of abnormal one may be detected instead, ruling the apparent anarchy. This increased heat quickens the movements of the heart, which propels more blood to the surface, where it is cooled. The same cause increases the need of breathing, by

which cool air is introduced in greater quantity, and by it the temperature lowered, etc.

The primitive causes of altered temperature in disease are the external influences, circumstances, or surroundings, the constitution of the individual, and the processes going on in the organism itself. We are yet powerless to measure the action of each of these causes on account of their intricacy; but we are already prepared to measure their sum total. The factors of abnormal heat escape mensuration, their quotient is within our reach by means of experiments, or by the artificial production of morbid phenomena. However, the results of these experiments are highly interesting, but not always to be trusted, because they are made on animals, whose range of normal temperature is larger than man's; the rabbits, for instance. But even were the experiments conducted on healthy men, we must not forget that the results may not be the same in pathological conditions, and indeed may differ from one disease to another.

It requires great attention and much thermometrical experience to separate the *effects of accidental circumstances* upon the temperature of the sick, from the *effects of the progress of the sickness itself*, either in one of its periods, or towards its favorable or fatal termination.

The *depressors of temperature* abstract heat from the body, or increase the loss of heat, or hinder, or limitate the access of warm blood to the parts under observation; and it is not easy to find which, or how many, and in what proportion these agents are at work.

The experiences on *elevated temperatures* are more numerous than on the *depressed*. Any elevation above the norme originates either from an over-production, or from a diminished loss of warmth, or from both combined; but in elevated temperatures the respective shares of these conditions is not easier to determine than in diminished temperature.

Extreme degrees of *external cold* are the most certain means of abstracting warmth from the body; it may go so far as to render death inevitable. The greatest depression arrived at in rabbits before causing death was 9° C.=48.2° F. Those cooled down to 18° or 20° C.=64.4° or 68° F. could not regain their own temperature by being brought into a warmer medium, but were restored by artificial respiration.

There is no proof that *cold* brings on diseases; but *congela-*

tion and its sequels do, as in Walter's rabbits. On the other hand, the application of cold on febrile temperatures has proved it one of the chief antipyretic and antiphlogistic remedies, especially in typhus and exanthematic diseases. Cold drinks and injections cool transiently; cold compresses and applications, ice-bags and sitz-baths, act more durably, but little beyond their locality; wet sheets, full baths, and douches cool more generally and permanently. The benefits accruing from cold applications in fever do not depend simply upon the subtraction of an overplus of heat; the question is more complicated, and much is to be learned yet.

External temperatures above blood-heat, when long continued, have a morbid influence, and cause that of the body to rise. This latter fact is taken advantage of to restore a body temperature sunken below the norme by warm applications.

External irritants rather lower the temperature, mustard does not elevate it, pains depress it (Mantegazza).

Considerable hyperæmia (artificially produced) elevates the temperature. The temperature of the head rises in animals hung by their hind legs (Brown-Séquard). The ligature of an artery, throwing more blood to a collateral part, increases its temperature; conversely, narrowing or compressing a vessel lessens the temperature of the parts where it ramifies.

Therapeutics turn to advantage this action of heat and cold to increase or diminish the quantity of blood, as by local and general blood-letting, position, compression, ligatures, large cuppings (ventouses Junot), topical cold, heat, astringents, etc. The temperature is at first lowered by copious hæmorrhage from the lungs, stomach, intestines, uterus, and general blood-letting; but reaction soon follows, as remarked by Lorain, Baunder, and others. Even the menstruation of the sick, often preceded by a rise, is followed by a fall of temperature; during it variations are more marked, and the disease is often judged by that crisis.

Deprivation of food lowers the temperature, a fact taken advantage of in therapeutics; but its effects, especially on the sick, are complex. (See Chossat, *Mem. de l'Académie des Sciences*, viii., p. 438; 1842. Schmidt, Lichtenfels, and Fröhlich.)

The *introduction of nutritious substances*, which does not

affect the temperature of the healthy, elevates that of the sick or convalescent 2° C.=3.6° F. for a few days.

Constipation, retention of urine, and suppression of the catamenia raise the temperature; very relaxed motions lower it, particularly when induced by purgatives. Vomiting depresses it more yet, even to the point of collapse.

The *lowering of the temperature by alcohol* is with the sick the same as with the healthy, only more marked. Poisonous doses of it depress considerably; cases have recovered in the London Hospital, after a fall to 32.2° C.=90° F. The ingestion of alcohol diminishes or retards the tissue-changes. Though usually followed by a reaction, the effect of alcohol in fever is to lower the temperature. Habitual *soakers* have, as a rule, a lower temperature than the average patients, and fall more easily into collapse, though a high temperature is often met with at the termination of fatal cases of delirium tremens. Other more or less poisonous substances depress the temperature—ether, chloroform, chloral-hydrate, opium, hydrocyanic acid, hyosciamus, digitalis, belladonna, tobacco, euphorbium, camphor, acetic, oxalic, sulphuric, nitric, and hydrochloric acids; the mineral acids altogether, and saline purgatives also.

The *raising of the temperature* is one of the effects of the toxic incorporation (in health or disease) of many substances, as coffee, musk, curare; it follows, too, the subcutaneous introduction of certain animal substances, like pus, or the blood of other animals suffering from fever of any kind (Demarquay, Billroth). This depends not on the fibrin, since beating and filtering do not change the result; nor on the pus-corpuscles, but upon the serum of the fluids, which keep this *toxic property* even when boiled and filtered. The maximum of temperature thus incited is obtained in two or three hours, the return to the normal in three to six (Fręze); and E. Bergmann, who made other observations of the same kind, says that subcutaneous injections of large quantities of water, or smaller of irritative substances, produce very similar alterations of temperature to those noted by Freze.

The specific morbid processes, like septicæmia and pyæmia, resemble the pyrogenic action of animal substances introduced into the system; but most of them are imperfectly understood. Andral states that when the blood contains more than $\frac{4}{1000}$ of fibrin the temperature rises in a corresponding ratio; thus

pneumonia, being noted for its great increase of fibrin, presents the highest temperature of all the phlegmasiæ, from 39° C.=102.2° F. to 41.2° C.=106.16° F. But in acute pleurisy there is less fibrin, and the maximum temperature averages 39.5° C.=103.1° F. Though he does not consider an excess of fibrin as the only cause of abnormal rise of temperature; for in pyrexia (where there is no such excess), the temperature is as high or higher than in phlegmasiæ. Thus 42.4° C.=108.32° F. has been reached in typhoid, 42° C.=107.6° F. in the onset of small-pox, in the hot stage of ague, in glanders, etc.; indeed, the highest degrees appear in diseases where there is the least fibrin in the blood. The number of red globules does not much affect it. The escape of albumen in the urine may lower it, but facts are wanted. The amount of urea in urine is a good test of fever; 10 to 15 per 1,000 are considered normal by Andral, who found in 53 patients whose temperature was normal, $\frac{12}{1000}$ average of urea; in 45, with non-febrile diseases, from 4 to 12 per 1,000; but in 23 cases of intermittent fever the urea ranged 13 to 32 per 1,000 (W. B. Woodman)

The influence of the nervous system upon temperature has been the object of extensive researches, the most important to be summed up here.

In his *Experimental Researches* (page 9, Phila., 1853), Brown-Séquard expressed the opinion that the increased warmth following the section of the cervical sympathetic ought to be attributed only to a paralytic dilatation of the cephalic blood-vessels, and to the consequent larger amount of blood flowing in the parts. On the increase of animal heat after injuries of the nervous system his conclusions are: An injury to the nervous system may cause either an increased or a diminished temperature in the parts which are paralyzed by it. It appears that the respective shares of the sympathetic and cerebro-spinal nervous system, in producing these, cannot well be determined. The degree of temperature of paralyzed parts depends on the quantity of blood which they contain, and this quantity varies with the condition of the arteries and capillaries of the parts. It is a matter of fact, hitherto unexplained, that the arteries and capillaries of paralyzed parts may be either dilated, normal, or contracted.

Becquerel and Brechet found out in 1841 a remarkable de-

pression of tei perature in animals whose body-surface was covered with an impermeable coating.

Budgé (*Comptes Rendus*, xxxvi. 377) has shown that this elevation of temperature is not produced by the division of the sympathetic, but that injuries of the parts of the spinal marrow which lay between the seventh cervical and the first and second dorsal have the same effect on the temperature of the head. Waller (in p. 378) attributes the rise simply to the paralysis of the circular fibres of the smaller arteries, and to the hyperæmia thus induced, caused by the section of nerve. De Ruyter (*De Actione*, art. *Belladonnæ*) explains this phenomena by a larger accession of blood in the parts.

Schiff observed that difference of the temperature of the two sides of the head (taken at the ear) may amount to 12°–16° C.; that this difference then, was proportionate to the difference in the quantity of blood in the parts; and that when (as exceptionally occurs) the section of the cervical sympathetic has no effect on the vessels of the ear, there is also no elevation of temperature; seeking to prove that the increased fulness of the vessels depends upon paralysis of the blood-vessels; and that the larger the quantity of blood, the higher is the temperature. He holds that, in complete spinal paralysis of a part, the temperature of this part must be elevated; but that in incomplete (paralysis of motion only), the temperature must be diminished; conclusions which have since been partially confirmed by pathological facts.

Later, Schiff excited fever by *injections of pus* into the pleura, or into the vascular system after dividing the left cervical sympathetic, or resecting the nerves of one extremity. As soon as the fever set in, the parts unaffected by the section rose in temperature, whilst those affected with vaso-motor paralysis (though previously warmer) rose slowly or not at all; and finally the former remained warmer than the latter: hence he concluded that the hyperæmia induced by nerve-section and by fever are of a different nature, the latter being the more active of the two.

Kussmaul and Tenner strengthened the doctrine which attributes the thermal phenomena to the amount of blood, by constantly reducing the increased warmth of the ear on which the sympathetic was divided, below that of the other ear, and even lower than its own temperature, before the section, as soon as

(in addition to ligaturing or compressing the carotid on the same side) they also ligatured the two subclavians at their origin, to prevent collateral circulation.

Brown-Séquard then discovered that *complete division of one lateral half of the spinal cord* in the dorsal region was followed by a rise of temperature in the hinder extremity of the corresponding side, and by a fall of temperature in the opposite limb. Schiff confirmed this, but attributed the fall to an accidental injury made to the other half of the cord.

Tscheschichin, after complete section of the cord in a variety of parts, always observed a suppression of the active operations of the vessels and a sinking of the general temperature, in addition to the loss of voluntary movements (1866). But when he divided the medulla oblongata in a rabbit, near to its junction with the pons, the temperature began to rise, the pulse and respiration greatly quickened. After half an hour the temperature was 39.4°—40.1° C.=102.92°—104.18° F.; after an hour, 41.2° C.=106.16° F.; after one hour and a half, 42.2° C.=107.96° F.; after two hours, 42.6° C.=108.68° F. More rapid breathing and convulsions set in; death half an hour later.

The pathological conditions analogous to the results of the former experiments are—the local alteration of temperature in neuralgias; observations of temperature in paralyzed parts; observations of variation of temperature in those forms of disease which are considered as vaso-motor neuroses; the effect of mental exertion or excitement in elevating the temperature, and of sleep in lowering it in fever; the great elevation of temperature in acute inflammation of the brain; the more enormous elevation in injuries destructive of the spinal cord; the very disproportionate rise of temperature at the end of tetanus and other fatal neuroses.

These facts favor the theory that a large share in the regulation of heat belongs, at least in complex cases, to the nervous system. The influence of certain nerve-tracks on the activity of the heart and on the circulation is indubitable; many of the pathological phenomena of warmth depend on the action of the vaso-motor nerves; the most remarkable alterations of temperature occur with profound disturbances of the nervous system, without corresponding anomalies of the circulation; and the integrity of certain parts of the nervous central apparatus is

more necessary for the regulation of animal heat, than that of any other part of the body.

Muscular exertions, as we said, cause a notable rise of temperature in cases where there is any previously existing morbid condition, however slight. On this account we are quite justified in feeling anxiety about the health of any one whose temperature exceeds the norme after only moderate exercise, however cheerful and apparently well he may seem in other respects.

During *convalescence*, temperature rises one or more degrees Cent. The first sitting up does the same; and the removal of a sick person so much more, that the first observation of temperature after the admission of a patient to a hospital, or after a journey, is not trustworthy.

This large enumeration of the influences which affect the temperature is not exhaustive. Many have been omitted as due to complications, others to phenomena known to exist, but not yet scientifically demonstrated, such as a process of fermentation of the blood, or chemical changes affecting the production of warmth, etc. The individual circumstances and surroundings, idiosyncrasies, etc., have also been left out.

A word about *age* to close:—

In children the temperature in disease is extremely mobile and sensitive, its extremes greater. *Women* resemble children in this respect; their temperature springs up or down without apparent causes, especially if they are hysterical; this mobility is found also among nervous men; those more advanced in years present more steady temperature with less susceptibility to impressions; *old people* present a temperature .5° C.=.9° F. less than younger persons. But this finding is so often attended by the effects of accessory diseases and of infirmities on the same function, that the safer way is to assert no rule till we know more about it.

Finally, the *repetition* of certain influences *augments the sensibility* of the temperature in some persons or cases, and *weakens or blunts it* in others.

CHAPTER IX.

LOCAL ALTERATIONS OF TEMPERATURE IN DISEASES.

The sickly variations of temperature are general or local. This antithesis is not absolute, but relative; since any considerable local alteration of temperature can hardly fail to be propagated to the rest of the body in certain proportion, through the circulation. On the other hand, a general rise of temperature is never so uniform as not to leave some parts cooler than others. But the two alterations are, nevertheless, distinct, and demand a separate attention.

In health, different parts have different temperatures; in disease, these differences are more marked.

Local elevations of temperature have been observed in inflammations, first by John Hunter, since by Brechet. John Simon found (Holmes' '*System of Surgery*, art. *Inflammation*,' vol. i., p. 43), and O. Weber verified, that the arterial blood supplied to an inflamed limb is less warm than the focus of the inflammation itself; that the venous blood returning from an inflamed limb, though less warm than the focus of inflammation, is warmer than the arterial blood supplied to the limb. And that the venous blood returning from an inflamed limb is warmer than the corresponding current on the opposite side of the body.

There is no trustworthy observation of a rise of temperature through simple hyperæmia (Billroth); there is an appearance of rise in exanthemata (Bärensprung); in neuralgia and local cramps the skin of the affected parts is somewhat hotter. As regards paralysis, Folet (in *Gazette Hebdom.*, 1867) gives the following conclusions from his long observations on hemiplegic patients:

In the immense majority of cases, the commencement of hemiplegia is accompanied with an increased temperature on the affected side; both sides are very seldom alike, and a di-

minished temperature on the diseased side is hardly ever noticed. The rise of temperature varies between .3° and .9° C..=54°—1.62° F.; but seldom exceeds 1° C. = 1.8° F. The presence or absence of contractures has no influence on the thermometric results. The thermometric difference may be greatly augmented by various causes. But the original cause of hemiplegia has no effect upon the result. Recovery from the paralysis tends to equalize the temperature again: if the paralysis continue, the height of the temperature varies greatly, and in one case may return to the normal in a few months; in others it may continue unequal for years together. Undoubtedly paralytic atrophy necessitates depression of temperature. In an old hemiplegia, when the affected side exhibits a high temperature, and the other side becomes paralyzed at a later date, either the two sides become equalized in temperature, or the side last paralyzed now becomes considerably hotter. The general temperature of hemiplegic patients is not usually above the normal, but exhibits an average height of 37° C.=98.6 F., except in the last hours of life, when it generally rises.

The results of Lépine's observations on hemiplegia show smaller fluctuations of temperature than in health, either upward or downward, under external thermal influences. In recent hemiplegia, the paralyzed limb exposed to cold loses more heat at first, less when the cold increases. In very old cases the paralyzed limb appears colder than the other, but remains relatively warmer. When exposed to heat again, it becomes less warm than the second one, exhibiting less sensibility to both heat and cold.

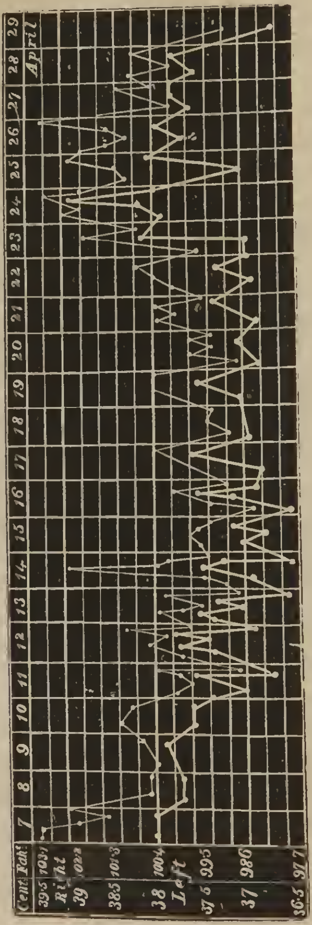
A girl, aged 18, presented during almost a year the following symptoms:—An increased temperature all over one-half of the body, connected apparently with spinal hysteria; higher temperature on the skin than in the vagina by .2°—.5° C.; and in the right axilla and groin more than in the left by 1.5° C.= 2.7° F. There were at times right-sided hyperæmias, urticoid eruptions, local sweatings, and various troubles in the internal organs.

Fig. 1 gives the traces of the movements of her temperature on both sides during three weeks. Here was evidently an affection of the vaso-motor nervous system, which acted on one side more than on the other.

In the same region, the deeper the observation, the higher

the temperature. In the urethra J. Hunter found it one inch deep 33.33°; two inches, 33.89°; at the level of the bulb, 36.11°; same increase in the rectum, etc.

Fig. 1.



Local temperatures in general and surface temperatures in particular differ much; a difference which may be accounted for, not only by regional susceptibility to frigeration from outside influences, but by the cooling of the blood as it reaches the extremities (see Appendix IX.). Thus, the nearer the heart, the hotter the region. Yet the arterial blood is hotter than the

venous in the limbs, and the venous hotter than the arterial in the viscera, according to Cl. Bernard, who found it warmer in the hepatic veins than in the hepatic arteries, and .6° higher when coming from the liver than when running through the aorta.

Pathological temperatures may be circumscribed to a part of the body, or to a single organ, or locality in it; or they may communicate their hyperpyrexy in variable degrees to the general temperature by propagation, or by the general circulation.

The proofs of higher local temperatures abound: In two cases of stomatitis, Roger found 37.75° and 38° in the mouth, with 37.5° in the axilla. In phlebitis of the right femoral, the thermometer marked 38.5°; on the other side only 36.5°; in the inflamed tissues which encircle gangrene 1°—2° more than on its central surface (Alvarenga and others).

The most striking examples of peripheric frigeration with central hyperpyrexy are met with in intermittent and cholera. But local anomalies of local temperature are too many and varied even for enumeration, and we pass to the *alterations of general temperature* which are the most frequent and important phenomena met with in clinical thermometry.

CHAPTER X.

TYPICAL ALTERATIONS OF GENERAL TEMPERATURE.

In many diseased conditions the anomalies of temperature consist solely in its *increased mobility.* This extreme mobility is met with, not only in definite diseases, but also where we can recognize but slight disturbance of the general health—chronic, limited, or transitory.

We often meet with cases in which the temperature of a patient *remains a little above the normal*, either persistently or in the form of nightly rise. In addition, there may be the increased mobility above mentioned, besides isolated and apparently causeless elevations of temperature. This is seen in obscure disturbances, in incipient phthisis (S. Ringer), in convalescence (especially from articular rheumatism), and in the decline of diseases.

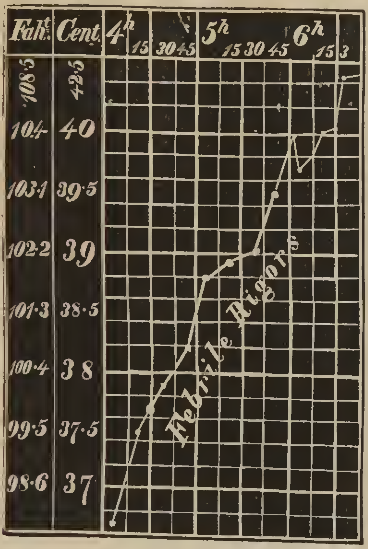
We meet more rarely with the *descending type* of temperature, in which the thermometer remains below the norme, or shows only rare intercurrent elevations. This form is seen in inanition, marasmus, cancer, diabetes, extreme anæmia, rarely in phthisis; in mental depression, lypemania, chronic and declining diseases.

The affections whose *alterations of temperature assume a definite and characteristic type* come next in order. Their types are: the rigors, chills (*fieberfrost*), cold stage of fever, fever-heats, hot stage of fever, pyrexia, collapse. These alterations of temperature are not the sole characteristics of these pathological processes, but simply those which we will study here.

During the rigor the temperature of the body is about 40° C.=104° F., even more; but the extremities are cold, bluish, or pale, and affected by automatic movements, accompanied with thirst, watery urine, etc. The rigor occurs at the beginning of the fever, or is an incident of it; but generally the excess of temperature precedes the rigor (see Fig. 2), at first in the body,

and subsequently reaches the extremities. This is the typical cold stage, from which there are deviations and attenuations, and which finds its analogue in the shivering of nervous people in some forms of intoxication, etc.

Fig. 2.



Rigors occur, also, with a falling temperature, or in the midst of an elevated one, or when it rises 2° to 3° C. rapidly from a very low point, say 35° C. = 95° F. This and the absence of rigor in many instances of elevated or falling temperature, shows that we must look for the cause of the *fieberfrost* in the suddenness of the difference of temperature between the periphery and the viscera, or the extremities and the trunk.

Pyrexia (*Fieberhitze*, or fever-heat) may follow rigor, or may start from a normal point, as in the ephemeral fevers of convalescents. Discomfort, thirst, and other subjective feelings, may be absent; but oftener they are present, and with them are found alterations of the pulse, of the urinary secretions, of the breathing, etc. Indeed, there is no necessary parallelism between the height of the temperature and the kind and degree of the other phenomena; and though this may lead to the theoretical belief that temperature is a deceptive guide, practically the reverse is empirically true.

During pyrexia some parts may be warmer than others; and

by this we mean not only the body, but the head, or ears, or palms of the hands, etc.; the height of temperature may vary greatly, or become excessive. Perspiration abates this, sometimes below the normal point. A tremendous increase of heat often precedes death.

Collapse occurs by itself in the middle of pyrexia, in the sequel of fevers, rarely during rigors, which it somewhat resembles. Not a disease itself, unexplainable by pathological anatomy, it is the shortest and last act of the drama of life.

When slight, it does not modify the appearance of the patient; growing worse, it substitutes for free circulation and breathing a cold perspiration, and annihilates the signs of vitality; it occurs after loss of blood, perforation of serous membranes, or chronic diseases; is most severe and protracted in Asiatic cholera. In chronic diseases collapse may be transient, prolonged, or repeated.

Cases of collapse with a falling temperature in the trunk are those most commonly met with in febrile diseases, and they require to be watched with the most painstaking care. The previously more or less high temperature sinks to the normal and often considerably below 35°—37° C.=95°—98.6° F. The fall is usually sudden, in a few hours or less. The descent may amount in half a day to 6°—8° C.=10.8°—14.4° F., or more. Cases of collapse may last a few hours only, or several days, through rises and falls, and the patient dies in it.

The collapse in which the temperature of the trunk falls occurs during the stage of defervescence, mostly in pneumonia, also in acute exanthems, etc.; then the condition may look critical and yet be quite devoid of danger; during the remission of fevers, oftener the typhoid; in the transition stage from intermittent fever to an apyretic condition, especially in pernicious malarial fevers and in pyæmia; during rigors in pernicious malarial fevers, in other severe diseases, and in very delicate and susceptible individuals; in incidental perturbations caused by blood-letting, vomiting copious evacuations, extreme nausea, pains, exudations, perforation of pleura or peritoneum, and the formation of coagula in the heart; in many kinds of intoxication and in the cold stage of cholera; in the pro-agonic period, and in the death-agony.

Cases of collapse with elevated temperature of the trunk are scarcely to be met with except in severe forms of fevers; and it

appears as if a very elevated temperature directly predisposes to such collapse.

Comparison between these three forms of constitutional disturbance—fever-frost, fever-heat, and collapse—shows that the temperature may be above the norme in all; always high in pyrexia, highest in febrile rigors, generally above normal in collapse. No distinction, therefore, can be drawn between these forms from the mere height of the temperature. Normal and subnormal temperatures often occur in collapse, but exceptionally in case of incomplete rigors. The extremities are always cold in collapse, generally in rigors. A rapid rise at the trunk, with cold extremities, is associated with rigors; a rapid fall at the trunk accompanies collapse. The recurrence of warmth in a particular part, when that of the trunk remains high, is peculiar to collapse.

We are met by insuperable difficulties when we try to explain theoretically the true meaning of all these varieties of temperature. Previous attempts at explanation had in view the theory of fevers, and ignored the condition of collapse itself.

But even as regards attempts to explain fever, temperature alone does not do it, complex organic phenomena cannot be solved by one simple formula. Those of Virchow, in his *Hand-book of Pathology*, etc., Zimmerman, Cl. Bernard, Schiff, Traube, Marey, Auerbach, Wachsmuth, Billroth, O. Weber, Senator, etc., though one-sided, throw light on the subject but fail to explain, '*On what does the abnormal temperature depend?*' Fever remains, after all has been said, a complex assemblage of varied phenomena, of which one of the most important is the alteration of temperature, though all the others cannot be explained by it.

Of all the symptoms, the *course* of the temperature must be studied first. Its principal alterations are: A general rise of temperature (all over the body), an increase of temperature in the greater part of the body, a general diminution of temperature all over the body.

An increase of temperature all over the body (an ordinary phenomenon at the beginning of a fever) is determined by a deficient abstraction of warmth, itself attributable to a variety of causes; from a pathological focus of warmth-production, the ustion is communicated to the entire body through the circulation; an abnormal activity in the modes of production of heat

may cause a general elevation of temperature, if the means of giving it off are not adequate. A general elevation of temperature may also occur through pathological chemical processes, as an increased combustion of hydrogen in fevers, or a sudden diffused organic decomposition producing caloric, or an over-production of heat by extreme muscular contractions towards a fatal termination, or new combinations of elements putrescent or fermentable, not demonstrated yet, but probable, such as could be produced by the transfusion of fever-blood, or of the ferments advocated by the zymotic theory. Alterations in the degree of activity of the vaso-motor nerves can, if extensive and persistent, influence the temperature in several ways. Elevation of temperature may occur in consequence of a morbidly increased action of the spinal centres. At times the above causes combine or succeed each other so as to render difficult a judgment upon their respective influence.

And lastly, the *same temperature* may indicate a very different quantity of over-production of heat, according as the amount given off is diminished, normal, or increased. Here are present opposite constitutional disturbances, since, in long-continued high temperatures, urea may be in excess, and the body lose a great deal of weight; or the latter may waste but little, and furnish few products of tissue-change.

An elevated temperature which extends *over the greater part of the body*, whilst that of other parts is lowered, may arise from an unequal distribution of the heat produced in the body, or from an unequal cooling through the surfaces, in contrast to the continual increase of internal production of warmth; oftener from unequal fulness of the blood-vessels. But it may come from a variety of causes: a patient in rigor and another in collapse feel very differently, notwithstanding the fact that the contrast between the temperature of the trunk and that of the extremities is identical in both.

A lowering of the temperature all over the body can only be induced by diminished warmth-production, increased loss of heat, or both these conditions together. It may occur after previous normal, low, or high temperature. In the latter case the fall may not be so low as 98.6° F., and yet have the same import as if it had fallen under the norme. It is difficult to assign the respective share of diminished production or of increased loss of warmth, in a fall of temperature; it is easier to

detect its causes either by its mode of progression, or from the action upon it of some remedies.

The remaining phenomena of rigor, pyrexia, and collapse may be attributed to the altered temperature itself, but react upon the temperature in their turn; for instance, an increased temperature affects the movements of the heart and respiratory organs, but an altered rhythm and force of the heart, and changes in the respiration, affect the temperature: this shows the interdependence of organic operations, whose combinations would defy human reason, were it not that disease itself has its laws, which we can discover by laborious observation, though we cannot yet codify them.

Thus *a rigor* is a complex commencement of a series of phenomena, rarely a process complete in itself. It is most sure to come when the temperature of the trunk rises so rapidly that the extremities are left in the cold behind. But this condition is not inseparable from a rigor, nor a rigor from it; since rigor may be absent, in febrient persons not very impressible, or after the use of quinine, though it will not prevent the hot stage, etc. In very sensitive people a slight contrast of temperature will bring it, even in health.

Pyrexia is an effort of the warmth-producing and warmth exhaling powers to restore their equilibrium. It is preceded by rigor when strong, and without rigor when gradually brought about.

Collapse may occur as a primary phenomenon, or an episode in a short pyrexia, or at the close of a fatal disease. The primary depends on some nervous trouble, and is accompanied with great loss of heat and profuse perspiration. The episodic may be due to special influences, or to circumstances of the disease, by which are caused great and uncompensated loss of heat, particularly at the periphery. The pro-lethal may be due to similar causes besides an absolute deficiency in the production of heat. Collapse, during the transition from disease to health, occurs when from the height of an elevated temperature a rapid fall sets in. The favorable issue of this crisis at the end of a sickness is due to the restoration of the power of producing a normal instead of a morbid warmth.

CHAPTER XI.

DIAGNOSTIC VALUE OF A SINGLE THERMOMETRIC OBSERVATION.

A SINGLE observation of temperature is always an imperfect and unsatisfactory standard; it may have been taken at an important or insignificant or deceitful moment. However, a detached observation is worth taking, because it may decide if a person is healthy or ill, or feigning a disease; it gives an idea of the severity and urgency of a sudden disorder supervening on another; it assists in diagnosing one kind of disease and excluding others. Corroborated by other symptoms and circumstances, it may be the basis of diagnosis and prognosis; the divergence of a single temperature from the general course may be valuable; each observation of a series must be considered in some respects as a single one; the conclusions derived from a single observation are valuable in proportion to its thoroughness; greater accuracy in recording the temperature is needed to render valuable a single observation than a series, where a difference of .2° C=.36 F. is of no consequence, or at least will not affect the practical value of the conclusions.

With few exceptions the range of human temperatures (healthy and sickly) is 8° C.=15° F. Its minimum, more difficult to ascertain than the upper degrees beginning with 35° C.=95° F., rarely descends to 33° C.=9.14° F. Surface temperature in cholera has indeed been observed as low as 26° C.=78.8° F.; but how much higher in the vagina or rectum? Roger observed 32°–22° C. in sclerema.

The highest maxima recorded in the first edition of this book were by Currie in scarlatina, 45° C., and by Wunderlich in tetanus, 44.75° C.=112.55° F.; now we must record from the *Lancet*, 50° C.=122° F. in spinal affection. After death the temperature may rise higher, as it did in the case of Wunderlich, where fifty-five minutes after death it mounted to 45.375° C.=113.675° F.

But even temperatures of 42.5°—43.5° C.=108.5°=110.3° F. are exceptional. The high temperatures met in even fatal diseases do not commonly exceed 41.5° C.=106.7° F. Narrow as seems to be this range, its included degrees are full of meaning for those who know how to draw conclusions from them.

Axillary temperature less than 38° C.=30.4° R.=100.4° F., proves actual absence of fever (apyretic). The nearer to that point, the closer and oftener we must look; since, thence to fever there is no line of demarcation, circumstances will often decide; as when the highest temperature arises in the morning before the stimulation of food or exertion, etc., fever is more probable.

All temperatures which exceed 38° C.=100.4° F. are *suspicious*, probably febrile; 38.4° C.=101.1° F., mildly febrile; anything above, decidedly febrile. Then to determine whether the fever is moderate, considerable, or extreme, we must consider the time of the day at which the temperature was taken; the same temperatures being important or insignificant as they occur at the usual time of rise and fall, or otherwise.

Some temperatures exceed considerably those common in high fevers. They occur in circumstances where there is no corresponding development of fever. Either the other usual symptoms of fever are wanting, or they are not developed in a corresponding degree to the extraordinary rise of the temperature; hence the latter is called *hyperpyretic*.

When the temperature exceeds 41° C.=105.8° F., we may suspect the case not to be one of simple fever; if it rises higher, say above 41.5° C.=106.7° F., this suspicion becomes almost a certainty. The circumstances producing such high temperatures are varied. They occur in some specific forms, doubtless infectious, as malarious or intermittent, where temperature may rise more than once to 41° C.=105.8° F., or in relapsing fever above 42° C.=107.6° F., without being fatal. In diseases of a favorable type, terminating in recovery, 41° C.=105.8° F. is more exceptional, of shorter duration, and sometimes precedes the crisis. There are diseases whose chief character is *malignancy*. Some are *specific and infectious*, others are suspected of it, in which high temperatures are met with. The question remains an open one whether the excess of temperature causes the malignancy or the reverse? Typhus, scarlatina, measles, pyæmia, parenchymatous hepatitis, malignant pneumonia, puerperal fever, meningitis of the convexity, and fatal rheumatic

affections, present these sudden elevations of temperature; they last but a few days, but at 41.5° C.=106.7° F. the prospect of recovery is small; at 41.75° C.=107.15° F. death is almost certain.

During the last hours of life temperature sometimes rises enormously, often by a sudden spring to 41°—42.50°—44° C.= 105.8°—108.5°—111.2° F. It is so in tetanus, epilepsy, and hysteria, near a fatal termination, in inflammations of the brain and medulla spinalis, injuries to the upper part of the medulla, and in other cases where there had been no previous evidence of the nervous centres being implicated.

Collapse temperatures are not identical with collapse; for they may happen without it, and collapse may happen with an elevated temperature of the trunk.

The *absolute height* of a given temperature, without its antecedents, can mislead in diagnosis and prognosis. Thus isolated the highest only portends danger, with this limitation: higher temperatures are borne in typhus and typhoid fever than in pneumonia, in scarlet fever than in measles, in relapsing fever than in any other; there 42° C.=107.6° F. being almost free from peril. The highest temperature in a case of recovery was 43.6° C.=112.5° F., the case of sunstroke reported from Bellevue Hospital by Dr. Atzembach; 43.3° C.=110° F., the case of rheumatism of Wilson Fox. 43.3° C.=109.94° F. was noted by Mader of Vienna, in a soldier suffering from irregular intermittent, repeated hæmorrhages, deafness, etc.; transfusion saved him; one case of sunstroke at 42.8° C.=109.4° F., and two of relapsing fever at 42.2° C.=107.96° F. recovered; since came in February last the case of 50° C.=122° F. recorded in Chapter XX., § 11.

It is not easier to assign the limits of the temperature downward. The lowest among the cases of recovery of Wunderlich was 33.5° C.=26.8° R.=92.3° F., pulse 62 (collapse of defervescence in enteric fever). Roger does not record any cure of children below 32.5° C.=90.5° F. (axillary temperature), and 24° C. in the mouth (an uncertain locality in cholera). In all less extreme degrees of temperature attention must be paid to idiosyncrasy.

In *children* the significance of temperature is in the main identified with that of adults; but their changes are more sudden and extensive; consisting in more sudden *plunges*, earlier rises, and a somewhat higher temperature throughout. They

are affected more and quicker by incidental influences; so that a high febrile temperature in a child, unless from malarious origin, has not the same import as in adults, where it would almost warrant a fatal prognosis; but it must be watched more closely, since it ends sooner, either way, in twelve or twenty-four hours. Ephemeral fevers are very characteristic of childhood; therefore we must not draw conclusions from the first or a single observation. We find their temperatures high in cases where those of adults are almost normal, particularly in convalescence, after muscular exertions, etc.

On the other hand, old people, everything but age being equal, show in sickness a fall from .5°—1° C.=.9—1.80° F. under the average, even below the minimum of younger people; this fall commences sometimes rather early, since between forty and fifty the majority of men begin to exhibit this senile character: so constant is it that in a given disease it will aid in determining the age of a patient. On the other hand, this physiological age of the temperature may lead to mistakes, for which see Charcot, *De l'État Fébrile chez les Vieillards* (Nos. 69 and 71 of the *Gazette des Hôpitaux*, 1866), and Bergeron, *Recherches sur la Pneumonie des Vieillards.*

Many *women*, and delicate, *effeminate men*, exhibit a similar course of temperature to that of children; let us judge them by the same standard.

The *time of the day at which temperature is taken* has a diagnostic value. In the period of digestion it rises more in the sick than in healthy people; this and other incidental influences must be taken into account, particularly in a solitary observation. Therefore, before drawing conclusions from a single thermometric reading we must notice the circumstances and the other symptoms, and consider whether they agree or contrast with the temperature, and see how many-sided are those symptoms and their relations. The temperature itself may be altered by an accessory disease of some organ, which itself modifies the other symptoms; or the altered temperature, and other symptoms, may result from a definite primary cause, infection, intoxication, or external morbific agencies, etc.

High and protracted alterations of temperature produce functional disturbances and even alterations of tissues; they lay the foundation of diseases of the circulatory, respiratory, secreting, and nutritive systems, and of the nervous functions

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generally. However, there is no *exact parallelism* between the high or low temperature and the gravity of the accompanying special symptoms; and we know empirically that, in particular, the gravest nervous symptoms do not coincide with the actual height, but oftener with the most versatile changes of the temperature.

If the temperature *harmonizes* with the other symptoms and the diagnosis deduced from them, it is an additional, and often decisive confirmation of the latter. But if the temperature *contrasts* with the other symptoms, we must *rely more* on temperature; but if it is less marked than they, we ought to *repeat* our thermometric observation, and make inquiries as to the type or stage of the disease which may cause the discrepancy. Then the discrepancy itself will be explained, either by the slight type of the disease, or by its advanced stage, or by some marked development, or by the initiation of collapse, etc.

If the heat is normal or slightly abnormal, and the *subjective symptoms* strongly expressed, we have reason to suspect stimulation or exaggeration, and to hunt it down; but if the expression of *subjective feelings* is very indifferent, and the temperature high, we have reason to suspect and to search for a severe and extensive disease, as typhus, etc. Otherwise, at the very moment of a favorable crisis, miserable feelings may concur with normal or subnormal temperatures: a form of defervescence verging on collapse, not to be overlooked.

Relations of ustion to circulation, respiration, etc. There is often a *contrast between the temperature and the frequency of the pulse;* though, as a rule, slight febrile heat coincides with a pulse of 80°—90°; moderate fever with 90°—108°; considerable fever with 108°—120°; extreme heat with 120° and upward per minute.

According to Aitken, in *Science and Practice of Medicine*, an increase of one degree F. above 98° corresponds with an increase of ten beats of the pulse per minute, as below:—

Fahr.	Cent.	Corr'g pulse.	Fahr.	Cent.	Corr'g pulse.
98	36.6	60	103	39.5	110
99	37.2	70	104	40.0	120
100	37.8	80	105	40.6	130
101	38.4	90	106	41.1	140
102	38.9	100			

According to Liebermeister:—

98.6	37	78.6	104.0	40	105.3
100.4	38	88.1	105.8	41	109.6
102.2	39	97.2	107.6	42	121.7

Otherwise their *relation* stands thus:—the pulse follows the temperature when there is improvement, and precedes it in exacerbations.

In children and nervous persons this relation is altered by the greater frequency of their pulse.

A pulse rather slow in proportion to the temperature is favorable as indicating a tranquil nervous system. A low pulse with high temperature invites us to look for some spinal cause, or pressure on the brain, depressing action of drugs, etc. Contrarily, a low temperature and frequent pulse points to local complications in the thorax or pelvis. Not forgetting, however, that moving accelerates the pulse of patients; altogether the frequency of the pulse is a bad gauge of the amount of fever.

The *number of respirations* per minute does not correspond so closely to the temperature as the frequency of the pulse. In collapse, there is often (not always) a frequency of respiration; and in slight fever of childhood also; in moderate fever the respirations amount to 20 or so per minute; in children to 40 or 50. In considerable or extreme degrees of fever they are higher yet, 60 in many cases; movement, also, increases their frequency. In other cases a quickened respiration indicates local causes.

Between the temperature and *cerebral symptoms* there is sometimes a concordance, sometimes a contrast. The brain symptoms accompanying fever are slight in grown people, and deep or serious in children and old persons. In adults delirium occurs with very high degrees of fever; if it is observed when the temperature is low, we must attribute it to a local affection. When the temperature is in the process of falling (as in collapse or defervescence), fierce delirium and maniacal outbreaks may appear, either of little import or similar to those preceding the death agony. The distinction must be made upon other grounds than the temperature and delirium.

Significance of the result of a single thermometric observation in a person considered healthy. In the healthy the fluctu-

ations are very trifling; yet, during menstruation, lying-in, suckling, dentition, rapid growth, bodily fatigue, mental depression, etc., temperature is often increased. Its maintenance near the normal point in these conditions is a capital guaranty of the capacity of endurance of the organism. A subnormal temperature in apparently healthy people is suspicious; the commonest deviation, a subfebrile temperature, indicates at least a morbid susceptibility. In children, particularly the youngest, this is caused by external influences, as excessive movement; in adults, particularly in the robust, it indicates some latent mischief, and invites an examination of the lungs, heart, etc., and a reapplication of the thermometer, and a vigilant supervision of the vital signs.

Significance of *a single observation of temperature in cases of apparently slight indisposition.* In such cases, thermometry offers a rapid and striking method of acquiring information. When the temperature is found normal, the slight character of the illness is confirmed (yet it is well to repeat the observation a few hours afterwards). Even subnormal or subfebrile temperatures do not denote a serious malady, provided the observation is not taken at the beginning of a disorder. But inside of the fever-limits, vigilance is necessary, though in children, women, consumptives, etc., this excess of temperature may prove transitory. But a very high temperature must always prepare our minds for serious developments. Send the patient to bed and let him be watchfully nursed.

A diagnosis is seldom possible at the *very commencement of an acute* febrile disease. Proceeding by exclusion, a normal temperature, or a moderate fever, excludes true pneumonia, small-pox, scarlatina, typhoid fever; a high fever at the onset precludes typhoid fever, influenza (grippe), articular rheumatism; but, with the concurrence of other symptoms, opens the *area of probabilities* to exanthemata, acute tonsillitis, pneumonia, pleurisy, intermittent and ephemeral fevers, pyæmia, meningitis of the convexity of the brain, typhus, etc.

The diagnosis of an acute disease is still very doubtful *during the first half of the first week*, unless thermometry can assist in making it at the first observation, which it cannot always do.

Subnormal and collapse temperatures only occur in diarrhœa, cholera, hæmorrhages, perforations, toxic gastritis, etc.

In the early days, a *normal evening temperature* suggests the

idea of intermittent fevers. But if the *morning temperature* is also found *normal* (unless some special circumstance keeps it low), we may almost conclude that there is no disease. However, catarrhal affections, measles, pleurisy, acute tuberculosis, granular meningitis, and acute rheumatism may be present with a normal morning temperature; whilst subfebrile or slightly elevated febrile movements have about the same significance. A high febrile temperature the first or second day, particularly in the morning, precludes the idea of typhoid fever, or proves that it began longer ago than indicated by the other symptoms.

To conclude: a single observation indicating a high degree of fever, scarcely allows us to form a conclusion as to the kind of morbid process which is going on for the first few days; but if we are able to exclude the possibility of an intermittent fever we may with great probability expect a severe illness.

Even in the *second half of the first week* of a febrile illness, the diagnosis may remain very uncertain in the prodromal fever of exanthemata, typhus, typhoid, and relapsing fevers, tardy pneumonia, etc., in which a solitary reading of temperature conveys but scanty information. But if this isolated reading shows an evening temperature normal, subfebrile, or hardly high (without depressing influences), there is no exanthematic nor typhus fever; if a high fever, we may exclude tubercular meningitis; if hyper-pyretic temperature, we are warned of masked intermittent and other malignant or infectious diseases; thermometry must be persevered in before forming hasty conclusions from its first application.

When an exanthematic eruption appears, with yet doubtful characters, if the temperature (previously high) becomes low, it is the small-pox; if normal, it is the varioloid; if it falls (but from a previously small height), it is a syphilitic exanthem; if it does not abate after the apparition of the eruption, it will prove to be the measles, scarlatina, or typhus.

During the further course of an acute febrile disease, when its diagnosis is uncertain, or appears so, the temperature continues to afford the most important information, and the observations must be continued. Yet, even then a single observation may be of great value: it may remove a doubt, decide on the severity of the disease, indicate its modifications, as well as the

danger and possible complications of it. It is thus that we can hardly admit the presence of typhoid fever when at any time, between the third and tenth day, the temperature is not somewhat febrile, and considerably so in the evening; that a low temperature, contrasting strongly with the high previous ones, raises the suspicion of internal hæmorrhage before any blood has appeared; and that, even later in the third week, typhoid fever is doubtful if the evening temperature (accidents excepted) is less than 39° C.=102.2° F., etc. But a high morning temperature of 40° C.= 104° F., or an evening one of 41° C.= 105.8° F., are signs of great severity; and a normal temperature in the morning at a later period, is no proof that the fever is over, if it still continues to rise in the evening.

When the temperature remains febrile after the eruption begins to fade in *measles*, and little later in *scarlatina*, it threatens complications; in *small-pox* the same symptom precedes the suppurative fever or complications.

In (true) *lobar pneumonia* a single normal or subfebrile temperature is no proof that the process is over. All high febrile temperatures in pneumonia are severe symptoms; more so after the sixth day; though a striking rise of temperature sometimes precedes the favorable crisis. In spite of other alarming symptoms, a normal or subfebrile temperature at a later period promises recovery.

In *facial erysipelas*, a febrile temperature announces further extension of complications.

In *influenza and bronchitis* high fever, in the morning or late in the disease, indicates extension to the finer bronchi, supervention of pneumonia, or masked deposits of gray or miliary tubercle. In whooping-cough, complications are to be expected from high fever in the second period.

In *acute articular rheumatism* a single observation is useless, unless it shows a very high temperature, which is dangerous.

A high temperature *in meningitis* points out the seat at the convexity or summit of the brain; contrarily, a weak apyretic temperature indicates granular meningitis of the base; but temperature may reach almost to any height in *cerebro-spinal meningitis*.

A high temperature, at any time, indicates great danger in

pleurisy, pericarditis, endocarditis, peritonitis, while a moderate or apyretic one does not insure a favorable prognosis.

In presence of a *gastro-intestinal catarrh*, if the patient has been in good condition and not exposed, a single observation showing a high temperature, excites a suspicion of typhoid fever; yet a second observation of high temperature is necessary to make it certain.

The diagnosis of *intermittent fever* is doubtful if the temperature, at the conclusion of the cold stage, or at the commencement of the hot, does not reach 41° C.=105.8° F., or if it exceeds 41.8°C.= 107.24° F., or if it is not normal in the intermissions. Although the *paroxysms* may have ceased with the other symptoms, as long as the temperature remains febrile, the intermittent is not cured.

During *defervescence*, isolated observations afford no satisfactory results, although a low evening temperature would be proof of the cessation of fever. When fever is about to leave, after a severe illness, the temperature rises and falls sometimes alarmingly in weak, sensitive patients; the closer to the crisis, the less dangerous are these collapses of defervescence.

After the termination of the disease, and in true *convalescence*, the temperature is normal, or transitory collapse-temperatures may occur. The latter may be caused by internal hæmorrhage or perforation of the bowels. Otherwise simple subnormal temperature indicates, if not danger, unsettled convalescence and deficiency of nutrition. The more mobile the temperature, the more unsettled the convalescence.

Febrile temperature in convalescence may be caused by error of diet in regard to quantity, strong meat or drink, exertion, and leaving the bed too soon, constipation, external influences, complications or extensions of the primary affection, or a new one.

A single temperature taken during a *great change* in a fever, may decide the tendency to a fatal termination. In a disease *without febrile character*, if the thermometer discovers an elevated temperature, it is noteworthy. In *nervous affections* hyperpyrexy may indicate supervening disorders or fatal termination.

In *jaundice* a high temperature is suspicious. In diseases accompanied with vomiting, diarrhœa, and particularly col-

lapse, a febrile temperature of the trunk indicates the commencement of reaction. If such temperature persists it may indicate exacerbation or complication.

In *chronic diseases with persistent fever* a single observation cannot detect anything; the observation must be continuous; but it can detect collapse-temperatures, which are more significant here than in acute cases.

CHAPTER XII.

DAILY FLUCTUATIONS OF TEMPERATURE IN DISEASE.

In disease, the *height* of the temperature varies more or less in the course of one day; observations representing it as stationary are to be disregarded. The daily *oscillations* of health have become *fluctuations* and *perturbations*; they range from 1°—1.5° C.=1.8°—2.7° F., even 5°—6° C.=9°—10.8° F., or more.

When the temperature is high and the daily variations slight, the disease will be severe and lasting. The daily fluctuations in different diseases, and in different patients from the same disease, assume different forms, yet agree in some points regulated by certain laws. These fluctuations written in figures may be operated upon as all other arithmetical quantities, and so give mathematical results; or drawn diagrammatically take the form of waves composed of crests and furrows. Each daily fluctuation is found to be a curve, composed of several secondary ones. To understand a daily fluctuation several observations are necessary, two to four during the exacerbations and remissions, or more, or even continuo , to follow the thermal law of the case.

The average of all the temperatures taken in a day, or adding the minimum to the maximum and dividing by two, form the *mean daily temperature*. The *daily difference*, or *ecart*, is the extent of the *excursus* between the *maximum* and *minimum* temperatures of the day. The elevations above the mean daily temperature are *exacerbations*, the depressions below it, *remissions*. The highest point of exacerbation just before a fall is the *acme*. The exacerbation which falls suddenly is said to be *pointed* or *acute*, the one which lingers at the *acme* before sinking is *broad-topped;* this may show a sinuous outline called double or triple-*peaked* exacerbation; the highest is the *max-*

imum of the exacerbation. The maximum of several exacerbations may not correspond with the maximum of the day. The lowest point in a remission is its *depth* or *nadir*. If there are several, the lowest corresponds with the day's minimum. The time occupied by the rising of the temperature above its daily mean, and its coming again to it, is the *extent* of the exacerbation ; the same movement downward is the extent of the remission. The moment the temperature rises from the *nadir*, it has begun its daily ascension, moderate, tedious, interrupted, extreme, or sudden. The daily *descent* begins from the last point of the exacerbation, even if it is not the highest, gradual, interrupted, slow, or rapid: there are, in a day, as many exacerbations as remissions.

The *form* assumed by the *daily fluctuations* depends upon the elements which constitute the morbid process, and chiefly on the kind of disease, its intensity, the stage it has reached, the regularity, irregularity, or other peculiarities of its course, the improvements or relapses, the occurrence of complications or special events, the progress toward health, the fatal crisis. It may also depend on the idiosyncrasy of the patient, interstitial or external influences, therapeutic agencies. Thus the *daily fluctuations* exhibit very complex phenomena ; notwithstanding, they furnish valuable indications.

A single day's fluctuation may suffice to determine the degree of *severity* of a disease, and the *stage* of some of them ; but we must compare the variations and repetitions of these fluctuations during a certain number of days in order to form a safe diagnosis and prognosis, to decide as to ameliorations and relapses, to the operation of accidental causes, and to the action of therapeutic agents.

Among the conclusions to be drawn from the average temperature of a single day, is the important one of the *level*, if it is high, medium, or low. Whilst the base line of the daily oscillations in health is 37° C.=98.6° F., 0 on the physiological scale, it is seldom so low, ordinarily more elevated in disease; the *level* is below the norme in cholera, the sinking stage of some diseases, some collapses, and transitorily in defervescence.

The *daily mean temperature* furnishes at once indications as to the degree of fever present. In moderate fever the mean daily temperature does not exceed 39° C.=102.2° F. In somewhat high fever 39°—40° C.=102.2°—104° F., this in-

cludes remittent types with a mean of 39°—39.5° C.=102.2—103.1°, and continuous fevers with a mean of 39.5°—40° C.=103.1°—104° F. It shows high fever above 40° C.=104° F.; many diagnostic and prognostic conclusions depend upon this.

Highly febrile daily means, above 40° C.=104° F., are met with in pernicious (malarial) fevers, typhus and typhoid in their fastigium, in relapsing fever, in severe pneumonia, which may recover; but in other diseases this average makes death imminent.

A considerably febrile daily mean (39°—40° C.=102.2°—104° F.), met with in well-developed pyrexia and in the fastigium of inflammations, deserves consideration, particularly in catarrhs, acute polyarticular rheumatism, cerebro-spinal meningitis, neuroses, post-choleraic stage, trichinosis, diphtheria, dysentery, pleurisy, pericarditis, peritonitis, and all affections suspected to be tubercular or phthisical.

A moderately febrile mean (39° C.=102.2° F.) has a varied significance, as it occurs in continued or remittent febrile diseases, in their rudimentary state, in their beginning, or in their favorable crisis; but chiefly in cases in which in a single day the temperature sinks from high to normal or subnormal, after an uncompensated fall as in collapse, etc., in inflammation of the serous membranes, and in death-agony, when brought on by pressure on the brain, inanition, etc. When the daily mean is much affected by circumstances or medication, we must be cautious about conclusions.

The *daily difference*, or *extent of the excursus* between the minimum and maximum of the day, may vary greatly; and even when it embraces the same number of degrees in a high, and in a low mean daily, its signification changes entirely. In a daily mean of 37° C.=98.6° F., a daily excursus of 1° C.=1.8° F. is of no importance; but one of 1.5° C.=2.7° F. is suspicious. With a daily mean of 37.5° C.=95.5° F., a daily excursus of 1° C.=1.8° F. indicates a certain disorder; and 1.5° C.=2.7° F. indicates a disease, if not always a febrile one.

The *daily difference* grows in importance as the *daily mean temperature* becomes higher. The latter being 38.5° C.=101.3° F., a daily difference of less than .5° C.=.9° F. indicates a continuous fever; and less than 1° C.=1.8° F. a subcontinuous; and a greater daily difference with a daily minimum of 39.5 C.=99.5 F. indicates a remittent type. But when the

daily minimum remains high, an exacerbation of about 1° C.= 1.8° F. shows a high degree of fever with no sign yet of favorable termination; it is denominated *exacerbating daily fluctuation.*

If the *daily minimum* reaches the normal temperature, there is a true *intermission*, though we class the case as remittent, not intermittent; and if it reaches the subnormal, we class it as intermittent, though through great exacerbations the daily difference may be 6° C.=10.8° F. But *intermissions* are considered *real* only when all the symptoms of fever abate, and on their return assume the paroxysmal form; they are founded, not upon a single day's observation, but on the observations of the whole course of the disease. (See next chapter.)

The occurrence of remissions at the height of an illness, indicates improvement, transition towards convalescence; its continuance, with an increase in the amount of *daily difference*, confirms the progress of convalescence; the opposite signs indicate relapse or complication. When, in acute diseases, the difference becomes greater, by the fall of the *daily minima*, convalescence is progressing; but when the difference is greater (forming more acuminated peaks), with rising daily mean temperature, the patient is getting worse. When the difference is augmented, through the temperature becoming subnormal in remissions, it is either favorable, indifferent, or dangerous. When the remissions are unduly protracted (the patient seeming convalescent in all other respects), it shows that the disease has yet a hold upon him. Decreasing differences with decreasing daily means is favorable; decreasing difference with increasing mean temperature is dangerous; whilst decreasing difference with stationary means is of doubtful significance. But the differences may remain the same, in spite of the progress or diminution of the disease, because the exacerbations rise to a height corresponding to the fall of the remissions (stationary difference with increasing means); or by the exacerbations decreasing in proportion to the increasing depth of the remissions (stationary difference with decreasing means).

The *daily difference* is usually slight in very severe typhoid fever, in typhus, in the prodromes of small-pox, in the height of scarlatina, in the majority of lobar (true) or croup-like

pneumonia, in the last stage of acute fatty degeneration, in facial erysipelas, in meningitis of the convexity of the brain, and in the last stage of fatally ending neurosis.

On the other hand, the *daily differences* are generally considerable in moderate or medium typhoid fever, in the first days of a severe attack, and again in its convalescence; sometimes in the convalescence of true typhus, in the convalescence of small-pox and its allies, measles and all catarrhal affections, acute polyarticular rheumatism, basilar meningitis, acute tuberculosis, pleurisy, pericarditis, acute and chronic suppurations, pyæmia, the various forms of phthisis, and trichinosis.

Daily differences, which alternate between normal or subnormal, and considerable or high febrile temperatures, occur in the advanced stage of recovering typhoid, sometimes in the suppurative stage of small-pox and its allies, at the end of lobar pneumonia, in all malarial diseases, in pyæmia and septicæmia, acute tuberculosis, and chronic forms of fever. Such a change may also occur in the course of a single day's fluctuation, through some special occurrence, like hæmorrhages, etc. Daily differences between moderately high and normal or subnormal temperatures, are frequent in fevers of moderate severity and protracted defervescence.

In the majority of cases there is in a day (24 hours) only one exacerbation with one, two, or three peaks, and one remission with one minimal descent. This is the simplest and commonest form; but in complicated intermittent the entire fluctuation comprising paroxysm and intermission lasts 48 hours (the tertian type).

Generally the remission begins between the late evening and early morning, and the daily maximum begins late in the morning or in the afternoon. The morning remission generally reaches its lowest point from 6 to 9 A.M., and the daily maximum its highest from 3 to 6 P.M., but both extend several hours more. Such is the common course, yet we meet with cases in which, without altering the result, the exacerbations occur in the morning and the remissions in the evening.

In *collapse*, also, we meet with extraordinary low minimums in the evening.

The time at which the daily maximum and minimum occur may have a meaning. The early (noon) maximum is a sign that the disease is severe and at its height; whilst a late maximum indicates that the disease was trifling or has moderated.

An early minimum is considered an improvement, unless brought on by collapse.

Far more important than the moment at which the maximum or minimum is reached, is the moment when the daily rise of temperature begins (ascent), and the other moment when the temperature begins to fall (daily descent). The more punctually (supposing no external disturbance) the ascent begins every day, the more intense is the disease, and remote the cure. It is a bad sign when the morning rise begins before 9 A.M.; and worse if it begins earlier from day to day. A postponement of the ascent shortens the exacerbation and is favorable, even if the daily maximum is not diminished thereby; contrarily, the later the exacerbation declines, the more severe the disease.

The *suddenness* of the rise and fall may offer indications, in connection with extreme *daily differences*. The first rise of a few tenths of temperature occupy some hours, then it becomes very rapid in the middle, and ends as it began, very slowly.

An unusually rapid rise occurs in the early stage of acute diseases. Before a favorable crisis, a protracted rise of temperture, the last of its kind, often precedes defervescence: this ascent is sometimes broken by a short descent. A very rapid fall of temperature may precede convalescence, or mark collapse. A very slow fall threatens imperfect or absent remission for the morrow. Defervescence may be inferred when the morning fall, interrupted in the afternoon, resumes its descent in the evening. In somewhat severe fevers, the temperature lingers less in the low than in the high temperatures; it is therefore a favorable sign when the peaks are quickly attained and suddenly deserted.

The duration of the variations of temperature *above* the daily average is the *latitude of exacerbations*, and the corresponding movement *below* the daily average is the *latitude of remission*. If the former be longer than the latter, the case is judged severe; the more so at a late period of the disease. When recovery comes, equality is more marked between the two *latitudes*. In advanced convalescence the *curves of the remissions* become *broader*, *those of the exacerbations* more *pointed*. Exacerbations of great extent have double or multiple summits; in the double-peaked one, the highest is that of the evening. They begin at noon, not in the morning. These many-crested fluctuations are unfavorable.

In many forms of disease presenting complexity, two or more exacerbations succeed one another in the course of twenty-four hours—*duplex and triplex exacerbations*—and are closely related to the *multiple-peaked* ones, just described. Their meaning varies according to the degree of daily difference, the type of the fever, in proportion to the height (or lowness) of the daily mean temperature, to the tendency to a rise or fall of temperature, or to actual defervescence. But in fevers continuously high, the daily waves furnish little if any information.

In the pro-agonic stage the fluctuations are wavy; let us not be deceived by them.

CHAPTER XIII.

THE COURSE OF TEMPERATURE IN FEBRILE DISEASES.

In febrile diseases, the temperature exhibits rules which are common, and differences which furnish the data to distinguish their forms and varieties.

The temperature may remain continuously above the norme, till it has reached its maximum, or only descend below it from some accidental circumstance, whence it speedily regains its normal height, as in *continued* fever. Or the elevations of temperature are interrupted once, or several times, as in *intermittent* and *relapsing* fevers. In such cases, each interval of time, separated by the apyrexia, may be regarded as a fever in itself.

Sometimes the fever is like a *part of the disease*, at other times *accessory* or corollary to it: a great difference, since the course of the disease is affected by the type in the former, by the circumstances in the latter. The diseases in which the fever is essential are principally those with a *well-marked type;* those in which the fever is occasional, are mainly *atypical.*

The course pursued by the temperature in a given affection may be determined by *the nature of the disease:* the more typical the form, the stronger its influence on the course of the temperature; this influence is not the only one, but the greatest; by the *intensity of the disease:* even in typical forms this modifies the course of the temperature; *individual circumstances* in children heighten the temperature, in aged persons lower it; hysterical temperament, etc., modifies it. It is changed by *accidental influences*, which operate in proportion to their potency, but more on atypical than on typical forms; by *complications*, which supervening in a disease, modify the course of its temperature, sometimes obliterate the original type of it, sometimes introduce instead their own.

The course of temperature in febrile diseases may be divided into a number of *periods* or *stages*, which vary much in their significance; they are sometimes strongly marked, at other times very indistinct.

The pyrogenic stage, or initial period, assumes various *forms*, depending mainly on the fever preceding the local affection, or succeeding it, or running its course independently.

There are forms of disease with a *short pyrogenic stage*, in which the temperature rises suddenly in one line, or almost so, to its characteristic height in a few hours, a day, or one day and a half. (See Figs. 3 and 4.)

Fig. 3.

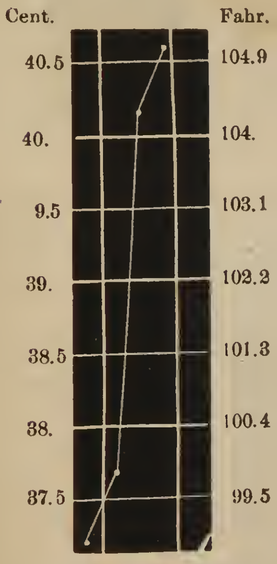
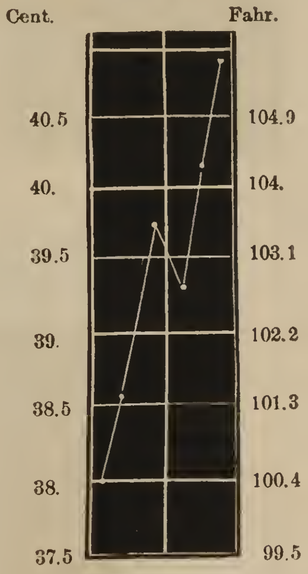


Fig. 4.



In these cases the forearms, hands, legs, feet, and face even, are cold, whilst the warmth of the trunk has risen considerably; there is chilliness, shivering, chattering of the teeth, till the extremities have approximated to the elevated temperature of the trunk. Attacks of illness, which begin with a short pyrogenic stage, have but short paroxysms of fever, with a sharp elevation of temperature, and a continuous course ending in less than a week by a rapid fall of temperature, or death.

This kind of *initial stage* is the rule in variolous affections,

scarlatina, croup-like pneumonia, pyæmia, malarial and relapsing fever; it is common in typhus, febricula, facial erysipelas, tonsillar angina, meningitis of the convexity. It never occurs

Fig. 5.

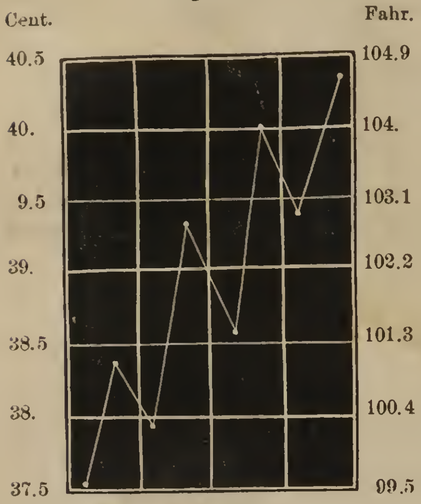


Fig. 6.

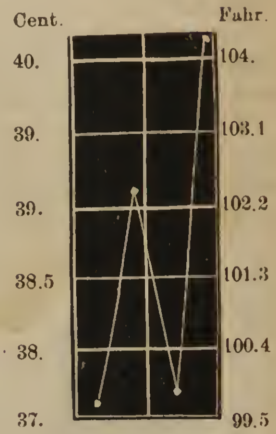
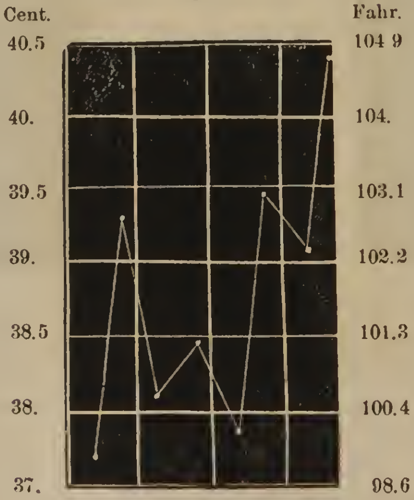


Fig. 7.



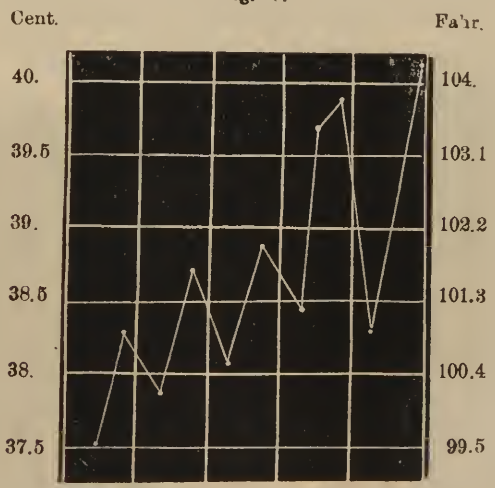
in typhoid fever, basilar meningitis, catarrhal affections, nor in acute polyarticular rheumatism.

There are other forms of disease with *protracted pyrogenic stage*, in which the temperature begins to ascend in the evening; the next morning it moderates, and rises more the following evening (Fig. 5). It may thus happen that the normal temperature is again reached in the morning of the second day (Fig. 6), or even that the initial stage is interrupted by a still longer interval of apyrexia (Fig. 7).

In this type the initial stage lasts several days, seldom more than a week. The height of the temperature indicates the severity of the disease, and suffices to establish the diagnosis of typhoid fever, other symptoms concording. Otherwise this protracted stage is initial to other affections—measles, catarrhal pneumonia, etc. (a class already enumerated).

There is also the *insidious initial stage*, which does not conform to rules, and whose type can only be approximated, as in Fig. 8. It initiates acute rheumatism, pleurisy, lues, phthisis, and numerous atypical affections.

Fig. 8.



The *fastigium* is the period in which the fever is most fully developed. At this stage the temperature experiences great variations from the many influences which affect the fever. The *acmé* is the summit of the fastigium.

The *variations of the height of the temperature in the fastigium* are relative to the *height of the maximum temperature*, or

highest point reached in a given case, which depends partly on the kind of disease, partly on its severity; but is not absolutely reliable in diagnosis, because it is sometimes brought to an unusual degree by collateral or accidental circumstances. The *lower range of the maxima* is also not absolutely reliable, because its observation may have not been taken at the opportune time; yet, for example, one can pronounce against the existence of intermittent fever after a careful observation, showing that the temperature never reached the lower range of maximum of this disease; or we may exclude typhus and typhoid fever if a temperature of 39.5° C.=103.1° F. has never been met with.

But the *variations in the height of the daily means*, or average daily temperature, are far more important *per se*, though they, too, are influenced by the severity of the disease, circumstances, etc. The *height of the daily means* is somewhat as follows in the fastigium of:—Typhoid fever, 39°—40.2° C.=

Fig. 9.

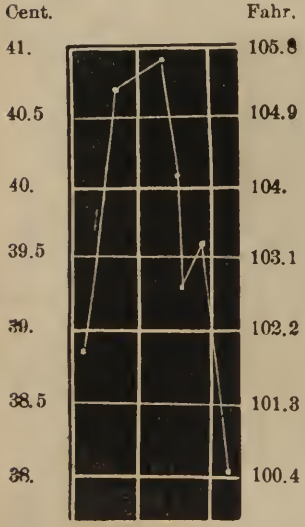
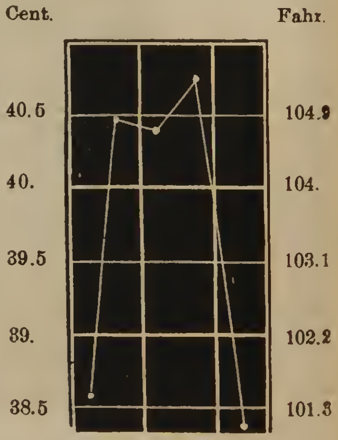


Fig. 10.



102.2°—104.36° F.; typhus, 39.2°—40.5° C.=102.56°—104.9° F.; eruptive fevers, small-pox, etc., 39°—40° C.=102.2°—104° F.; measles somewhat lower, on account of the extent of the morning remissions; regular scarlatina, 40° C.=104° F.; croup like

pneumonia, 39.2°—40° C.=102.56°—104° F.; meningitis of the convexity, 40° C.=104° F. or more; articular rheumatism, without complication, 38.5°—39.5° C.=101.3°—103.1° F.; acute influenza, 38.5°—39.2° C.=101.3°—102.56° F.; facial erysipelas, 39.5°—40° C.=103.1°—104° F.; parenchymatous tonsillitis, about 39.5° C.=103.1° F.

When this stage is short, the *average height of the fastigium* may be easily modified by circumstances, as one accidental remission or exacerbation, in which case we must disregard the mean obtained from them, in determining the intensity of the disease.

The most *valuable data* for diagnosis and prognosis are obtained from the *general course* of the temperature during the *fastigium.* Its form on a chart is *acuminated* (pyramidal), reaching rapidly to a point from which it rapidly falls, or where it ends fatally; or *continuous*, persistent at a certain height, with or without slight fluctuations; or *interrupted*, broken by considerable fluctuations in a single day, or by strong differences in several.

Fig. 11.

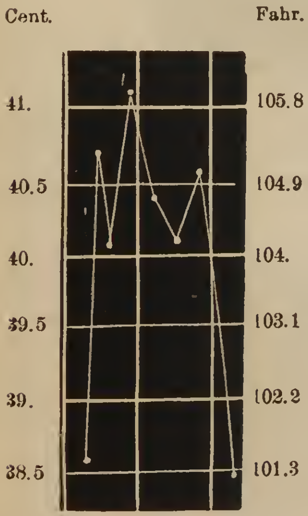
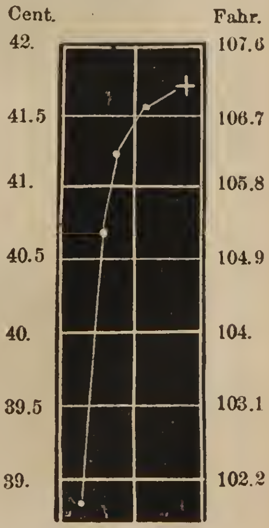


Fig. 12.



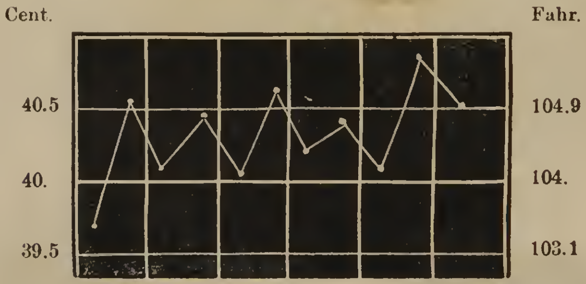
The *acuminated* course of temperature during the fastigium occurs in the paroxysm of short intermittent, in ephemeral, and malarial fevers, pyæmia, erratic erysipelas, seldom in pneumo-

nia; in fever accompanying herpetic eruptions and tuberculosis, and in terminal fevers generally. The fastigium may thus exhibit a single pointed summit (Fig. 9), a broad-topped maximum (Fig. 10), or several peaks (Fig. 11).

Lasting only a few hours, and rarely more than a day, the pyramidal fastigium either ends in death, as per Fig. 12, or falls quickly after reaching the acmé; two or more such attacks follow, as in malarial intermittent pneumonia, etc.; in these abrupt fevers a relapse is frequent.

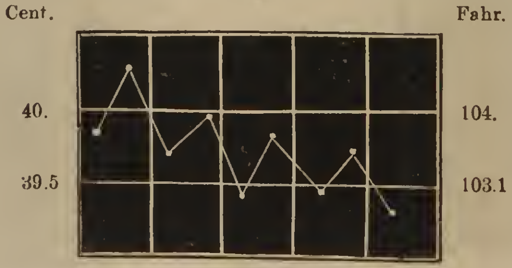
A continuous course is not always even, but may be undulated by slight fluctuations of .5° C.=.9° F., or a little more (see Fig. 13). It occurs in the fastigium of severe acute dis-

Fig. 13.



eases; in severe complications, and in very mild miscellaneous cases. The diseases which seem to have a predilection for this kind of fastigium are typhus, scarlatina, croup-like (true) pneu-

Fig. 14.

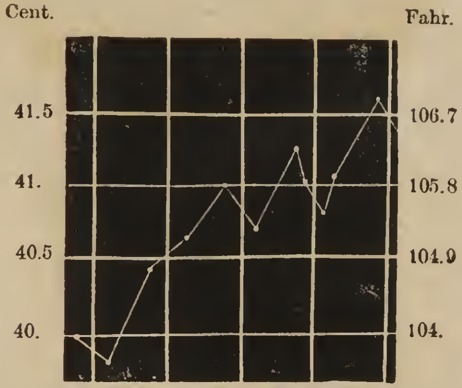


monia, the prodromal stages of variola and its allies, erysipelas before it spreads, meningitis of the convexity, severe general febrile affections showing microscopic lesions, or having a

short initial stage of rigors. When diseases, which usually exhibit the remittent or non-continuous course, assume this continuous fastigium, it is an unfavorable symptom.

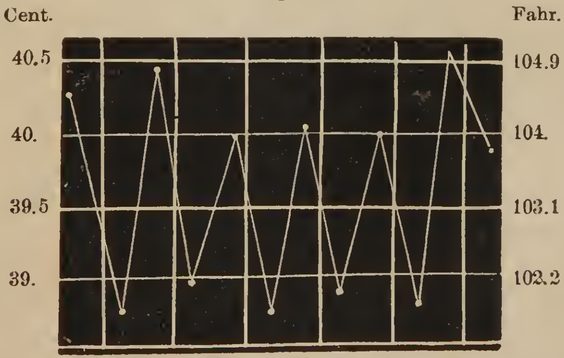
Here, the height of the average temperature is important; its continuous course is either ascending (Fig. 15), a bad sign; descending, a good sign (Fig. 14); or persistent on the same level, neutral. Usually the first part is more severe, the second milder. These parts are often divided by a fall of tempera-

Fig. 15.



ture, a *pseudo-crisis.* This continuous course of temperature during the fastigium. very seldom lasts more than a week, but it may be repeated in a moderate or *remittent* form.

Fig. 16.



In the great majority of diseases the course of temperature is non-continuous during the fastigium. This is the rule in

typhoid fever, catarrhal affections, catarrhal and putrid pneumonia, measles, osteo-myelitis, meningitis, pyæmia, lues, etc. The fluctuations between evening exacerbations and morning remissions may be considerable, therefore varying much the *daily maxima.* In cases of moderate severity the morning remissions fall more or less below the average height of the fastigium of the disease (Fig. 16); whilst in severe cases they remain above that average (Fig. 17).

Fig. 17.

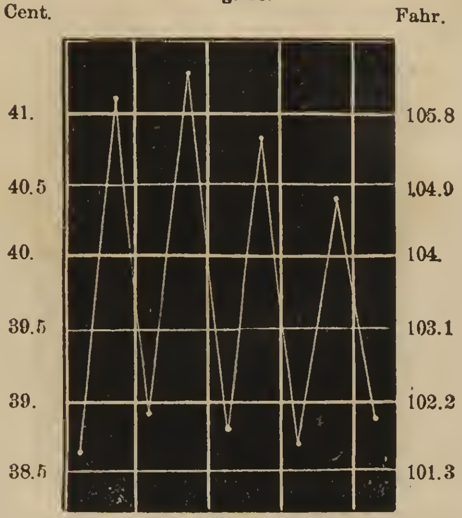
The extent or *excursus of the fluctuations* between the morning and evening temperature may range from .8° to 3° or 4° Cent.=1.35°—5.4°—7.2° F. (See Fig. 18.) The alternations between exacerbations and remissions may be repeated regularly for days and even weeks, almost identically; but in the *non-continuous course* the daily temperature may show more irregularities; as remissions and exacerbations occurring earlier or later, longer or shorter on a given day; non-concordance between the *depth* of the remissions and the *height* of the exacerbations; intercurrent *retrograde movements*, isolated and powerful *falls*, or *elevations* of temperature, symptoms rarely favorable; occasional intercurrent *elevations* of temperature due to some unfavorable development or complication; and more rarely present in *inter-current collapse.*

Often these irregularities combine by two or more, and a type once broken by them is seldom resumed; they are frequent in pyæmia.

The *varieties in the non-continuous course of temperature during the fastigium* result mostly from the nature and severity of the disease, and sometimes from complications. Typhoid

fever is the most typical of all the diseases with non-continuous fastigium. The minimum of its exacerbations is 39.5° C.=

Fig. 18.



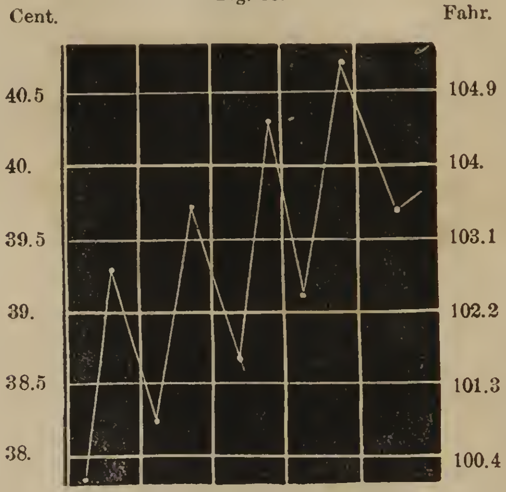
103.1° F. The limits of its daily excursions does not exceed 1.5° C.=2.7° F. Its course is regular (when uncomplicated). Its fastigium is never less than eight, nor more than seventeen days; even circumstances do not easily affect its temperature, still less its duration.

The *absolute height of the maxima of exacerbation* is considerable in the non-continuous part of recurrent or suppurating fever, variola, catarrhal pneumonia, etc. (as *supra*). On the other hand, it depends more upon the severity of the individual case in the opposite series, polyarticular rheumatism, pleurisy, etc.

The *daily difference* or *width of excursus of the fluctuations* depends on the form and severity of the disease. Sometimes the excursus is as extensive as in intermittent, sometimes as limited as in continuous fever. The latter are often severe; the former with high exacerbations, may lead us to suspect malignancy, pyæmic or septic infection, embolism, secondary deposits, etc., though some cases may recover without confirming or invalidating the suspicion, nor revealing the cause of such an extreme course of the temperature.

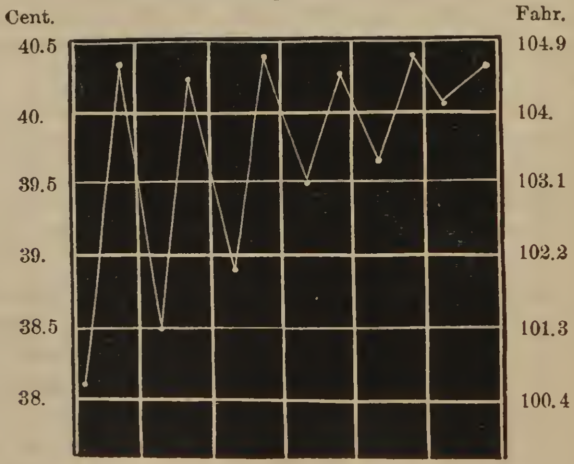
With the disposition of non-continuous fever to irregularities, any special event in the course of the disease, such as the action

Fig. 19.



of calomel, digitalis, cold water, etc., may produce sudden plunges, elevations, or collapse.

Fig. 20.



The *direction taken by the temperature* when the course is non-continuous may likewise differ, the fastigium being either *uniform*, *ascending*, or *descending*, rather corresponding in this

respect to the dangerousness of the disease. The *ascending* direction may consist in an increase in the height of the daily average of temperature (Fig. 19); or in the *remitting type* approximating to a *continuous or exacerbating* one (Fig. 20).

The *descending* fastigium is recognized by a contrary march, which usually effects a gradual, rarely a sudden fall, preceded by brief irregularities.

The fastigium may be broken in two periods of a whole or half week. If an ascending direction is succeeded by a uniform course, and then a descent, it warrants a favorable prognosis; but if a uniform march assumes an ascending direction, the case is bad.

The *duration* of the fastigium is longer in the non-continuous type than in the continuous; shorter (if not suddenly fatal), it indicates less severity; longer, more. The prodromal stage of measles, in favorable cases, has a particularly short fastigium. In influenza, bronchitis, cynanche tonsillaris, parotitis, catarrhal pneumonia, wandering erysipelas, suppurating fever of small-pox, peritonitis, reactive fever from cholera, the fastigium cannot last more than five or six days without danger; in typhoid fever, eight to seventeen.

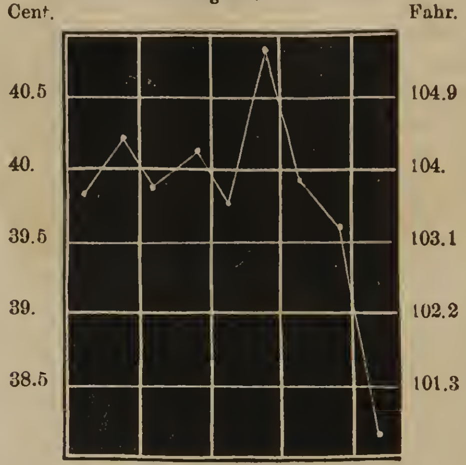
The fastigium lasts longer in polyarticular rheumatism, pleurisy, trichinosis, suppuration, cerebro-spinal meningitis, and lues, even when cure ensues. In basilar meningitis the length of the fastigium has no significance in regard to the issue; in septicæmia, pyæmia, and acute tuberculosis it rather has a favorable one. In phthisis and other chronic affections, the fever may persist for months, even for years, without much affecting the issue.

In most diseases the fastigium is simple; but it may be repeated more than once in the following affections: the relapses of typhoid fever, relapsing fever, small-pox, irregular exanthems, pneumonia (relapsing forms), pyæmia, and septicæmia (with apparent improvements intervening), facial (relapsing) erysipelas, polyarticular rheumatism (complicated), basilar and cerebro-spinal meningitis, pleurisy, and phthisis. When the fastigium repeats itself, continuous, remittent, and paroxysmal types may follow each other; the more continuously elevated becomes the fastigium, the more unpromising the case.

The *close of the fastigium* is sometimes clearly defined, sometimes indistinctly, merging into the following stages, or a

brief rise may terminate it; called in the good old language of physic, *perturbatio critica.*

Fig. 21.



In small-pox the fastigium ends as soon as the eruption becomes *shotty;* in measles it terminates when the eruption is at its height; in scarlatina, when the exanthem begins to pale; in pneumonia, when hepatization is completed, between the third and ninth day; in typhus, towards the end of the second week or the middle of the third; in mild typhoid fever, in the course of the second week, and in severe cases in the course of the third or fourth; in influenza it lasts a few days; in parenchymatous tonsillar angina, three to seven days; in other diseases the termination is more or less uncertain.

Most of the diseases have completed their evolution at the end of the fastigium by death or convalescence; others continue, after it, in a state of indecision—an *amphibolic stage.* This stage is most strikingly severe in typhoid fever; occurring also in lingering pneumonia, typhus, polyarticular rheumatism, epidemic cerebro-spinal meningitis; and is marked by great irregularities of temperature, which, however, seldom reach the maximal height of the fastigium. It may last more than a week, and lingers longest in grave typhoid cases. Intermittent collapse is often met in this period.

Certain *influences* may modify the fastigium or the amphybolic stage. A *rise of temperature* is induced in febrile patients

by mental excitement, bodily exertion, being kept too warm, errors of diet, persistent constipation, and the occurrence of certain complications. A *diminution of temperature* is brought on at this stage by hæmorrhages, copious stools, vomitings, or perspirations; also by imperfect respiration, paralysis of the heart, pressure on the brain, and starvation. Occasionally by a deep sleep, external application of cold, blood-letting; and the administration of medicines already recognized as antipyretic, calomel, antimony, lead, digitalis, veratrine, quinine, acids, and cooling salts: though the individual susceptibility to these agents differs greatly.

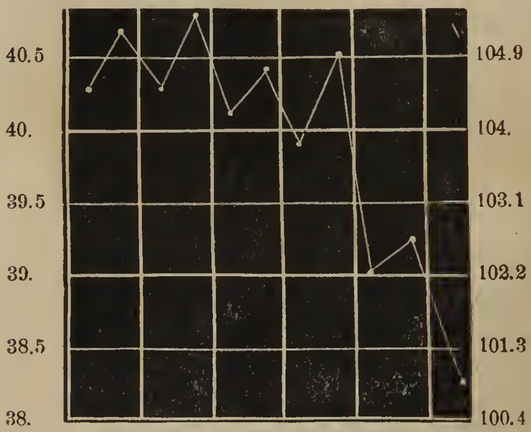
The course of temperature during *convalescence* differs as much as the modes of recovery. In one disease, the morbid process being exhausted, recovery takes place by a simple reaction; it is the course in typhus, varioloid, measles, lobar and uncomplicated pneumonia, febriculæ, relapsing fever, facial erysipelas, fever of the cholera reactions without parenchymatous degeneration of the kidneys. But in convalescence of other forms there is such alterations of texture, such organic destruction of old tissues, and so many new products standing in new organic relations, that in the midst of these conflicting elements convalescence becomes almost a secondary disease. So it acts in typhoid (enteric) fever, scarlatina, true small-pox, polyarticular rheumatism, all forms of meningitis, trichinosis, pleurisy, pericarditis, dysentery, etc. Complications, in the first class, may lead to the same difficult convalescence. In both classes the course of the temperature corresponds to these various relations, and judges the chances of recovery. In cases of laborious convalescence considerable elevations of temperature intervene in the midst of the healing process; this harmonizes with the fact that the greatest danger of patients often meets them in the period of recovery. On the other hand, where there is no great obstacle to recovery, the fever-heat passes away with the disease.

During convalescence the temperature passes through three periods: of decided, still insufficient decrease, the *stadium decrementi;* of cessation of fever, named by Wunderlich and known as *defervescence;* and the terminal, *epicritical* period of recovery.

The first stage cannot be observed in all cases; when present, it succeeds the fastigium or the amphibolic period; then comes a slight fall, at once followed by unmistakable defervescence. (See Fig. 22.)

This process may be gone through so imperceptibly that it is difficult to mark the commencement of defervescence. It may amount to .5° or 1° C. even to 3° C.=.9°—1.8°—5.4° F.; it

Fig. 22.



may consist in a moderation or absence of the regular evening exacerbation; or in a greater morning remission (with the ordinary exacerbation); or the morning remission is more, the evening exacerbation less marked, making the daily difference the same, though the average temperature of the day appear lower; or it may consist in a *pseudo-crisis* followed by a slight rise of temperature: so that the average temperature may be lower, and yet a slow fever persists for almost a week, till it is replaced by the true defervescence. This course is distinguished from the amphibolic stage by the absence of aggravations, by the normality of the rise of the evening temperature, and the regularity of the morning remissions.

This *stadium decrementi* may be met with in all sorts of diseases; defervescence may succeed it rapidly or lingeringly; therapeutics may hasten it. Otherwise, its length varies with the kind of disease; it is longest in typhoid fever and the suppurating stage of variola, shorter in petechial typhus and scarlatina, shorter still in measles and lobar pneumonia. In atypical diseases its length is variable. Such moderations of temperature are deceptive in pyæmia and the amphibolic stage of many diseases.

The *period of defervescence* proper is that which affords the safer indications as to anomalies and impediments to recovery. Defervescence may be complete in four, twelve, twenty-four, at most thirty-six hours, during which we witness a fall of 2°—5° C.=3.6°—9° F. and more, descending to normal or below it.

Fig. 23.

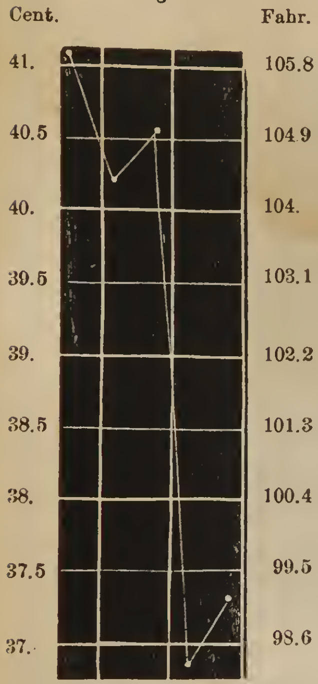
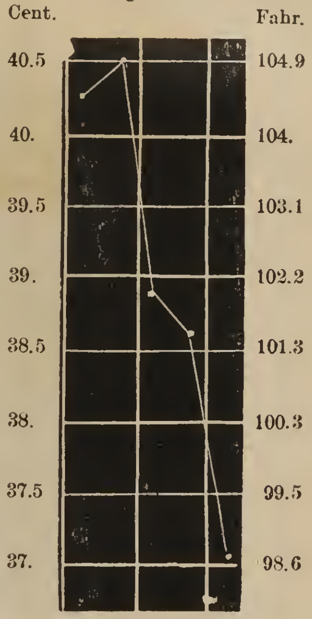


Fig. 24.

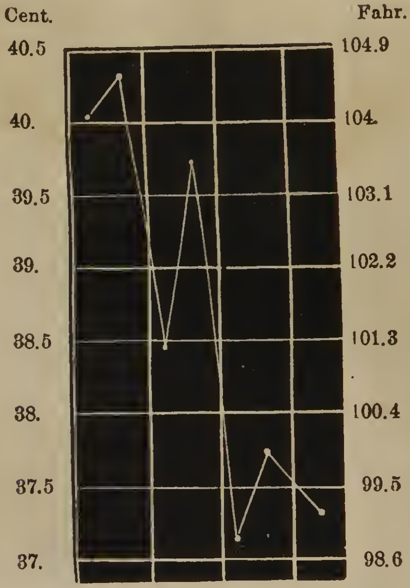


The fever may terminate in that short time; yet its end must not be assumed till we see whether the next exacerbation rises to the height of the previous day; if it does not, the defervescence is confirmed. It may also happen that the temperature rises a little on the second evening, but not considerably. (See Fig. 25.)

There may be no defervescence in the morning, only a moderate depression, even a heightening of temperature, followed by defervescence in the afternoon or evening, which instead of exacerbation marks a slight fall of .1°—.3° C.=.2°—.5° F. or a little more, which will serve as the basis to calculate upon the defervescence of the next evening. (See Fig. 26.)

The temperature often falls below the normal to 36° C.= 96.8° F., or even lower, especially when hastened by depressing remedies, and yet defervescence is assured only when the temperature of the next evening remains normal. After such rapid falls, collapse may follow, creating disturbance in the patient and anxiety around him. Thermometry enables us to

Fig. 25.

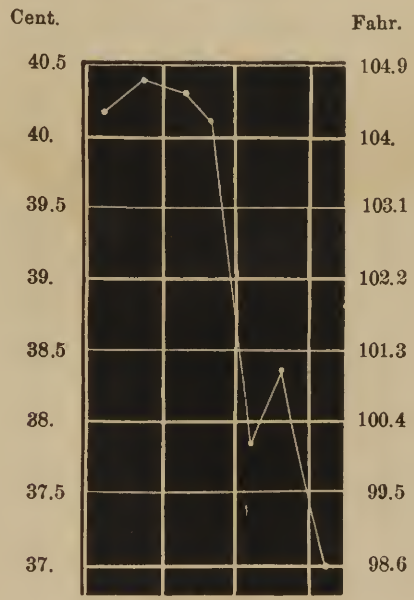


judge of the position. The critical condition may last several hours or days, accompanied with delirium and other symptoms; yet, if the temperature continues normal or subnormal everything is safe, but from the effects of extraneous events, like perforation. Relapsing fever presents the type of these rapid defervescences of 5°—6° C.=9°—10.8° F.; such excursus happens at the close of the first attack, or of the relapse.

An opposite mode of *defervescence* takes place more slowly on an *extended line* or *lysis.* Temperature *continuous*, falling tediously, less from morning to evening than from evening to morning, almost stationary; its decline occupies several days or a week (Fig. 27); so it is in scarlatina and typhus, sometimes in pneumonia, seldom in typhoid fever, etc. Or the *lysis* may affect a *remittent type*, in which morning remissions alternate

with evening exacerbations; but, on the whole, either the daily maximum, or the daily average, is less from day to day; this may last from three to seven days, even subject to interruptions. In this way evening exacerbations may continue high, and

Fig. 26.

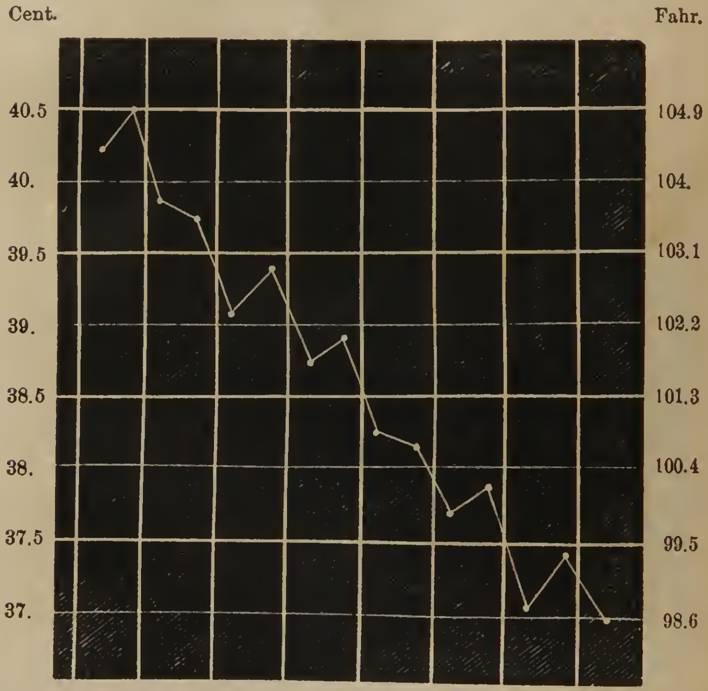


morning remissions become more marked, till the exacerbations decrease too. (Fig. 28.) Or, the daily differences remaining the same, morning and evening temperature become lower (Fig. 29); or the evening exacerbations gradually approximate the morning remission. (Fig. 30.) These various forms may succeed one another slowly or abruptly. *Remitting defervescence* characterizes typhoid fever, is met with in catarrhal diseases, trichinosis, peritonitis, pericarditis, and lasts about four days. Collapse frequently occurs in severe remitting defervescence, in consequence of the fall of the morning temperature being considerably below the norme during several days.

In the *epicritical period*, especially in *convalescence*, the temperature is normal in the morning and evening, showing only the daily fluctuations; a guaranty that the healing process will follow. But as long as febrile temperatures are met with in

the evening, convalescence is not perfect, and if in the morning, they are yet less promising. However, in several cases

Fig. 27.



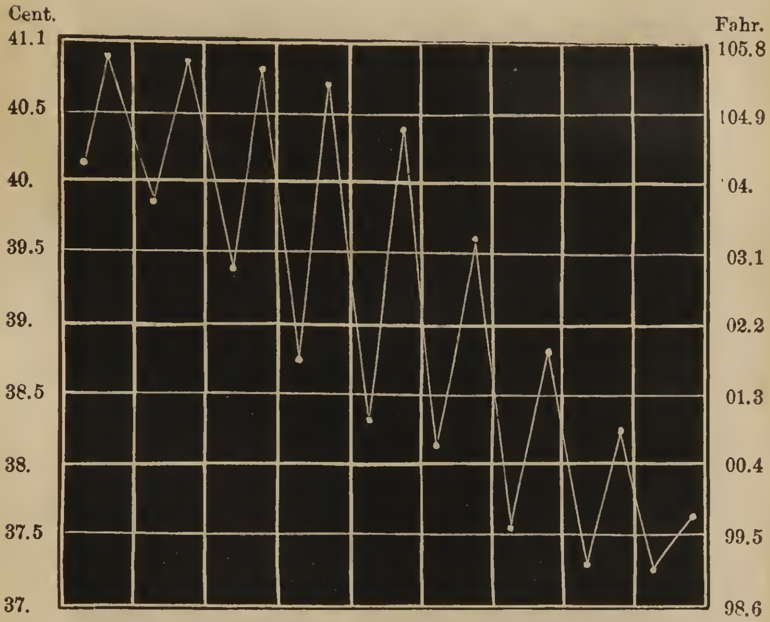
and diseases, convalescence is arrived at through these febrile elevations, which may be caused by an indulgence in animal food, early walking, etc.

The beginning of an acute affection (whether relapse or complication) during convalescence is always attended with a rise of temperature after the type of the new affection.

If an illness, instead of ending in cure or death, is followed by *sequelæ*, the healing process is retarded or interrupted, and exhibits many deviations from the norme. This passage from the primitive disease to its sequelæ may occur during the amphibolic stage, the decrement, or the defervescence; then the lysis is proved to be only apparent by a fresh elevation of temperature and the absence of farther progress, and the new course is determined by the nature of the sequelæ, not by that of the primary disease.

A *fatal termination* is preceded by symptoms long or short, threatening or promising. The *pro-agonic period* is far from

Fig. 28.

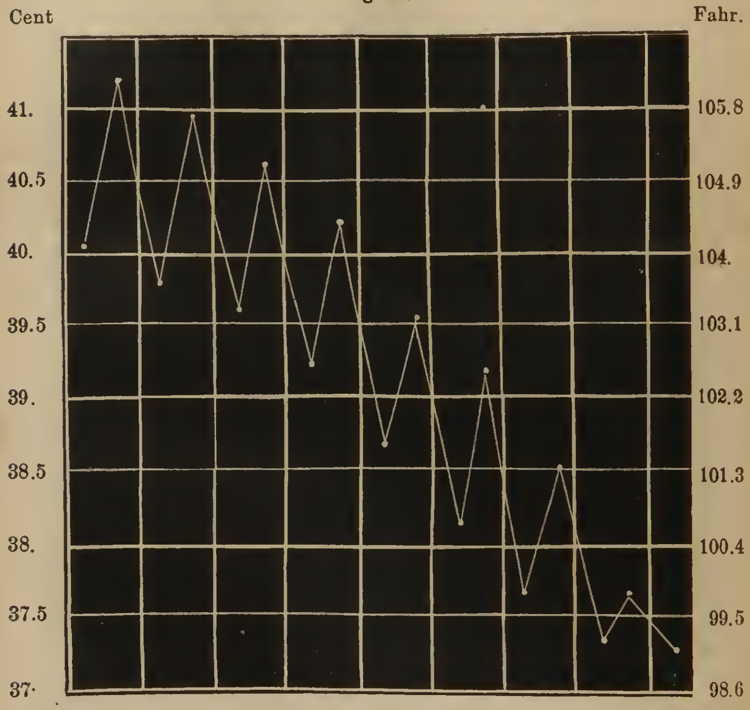


being simple, but thermometric observation throws a light on its *habits* and duration. By the light of temperature we see this stage assume various forms. The *ascending*, whose commencement may be uncertain, if its character is uniform with that of the original disease, or if an amphibolic stage has preceded; but are sharply defined if the primary disease has entered into the period of convalescence, even in that of recovery, or when the pathological temperature has been reduced by therapeutics. It is also well marked when the previous course was continuous, and especially when the pro-agonic period begins with a rapid rise in the course of a disease previously apyretic. In this ascending course the rise affects the form of a zigzag, slightly declining in the morning, rising higher at every evening exacerbation; thus the average height increases with the daily maxima (Fig. 32).

In this way temperature may continue to rise regularly

through the pro-agonic period, or it may succeed to an irregular course, or follow the fluctuations of the amphibolic stage;

Fig. 29.



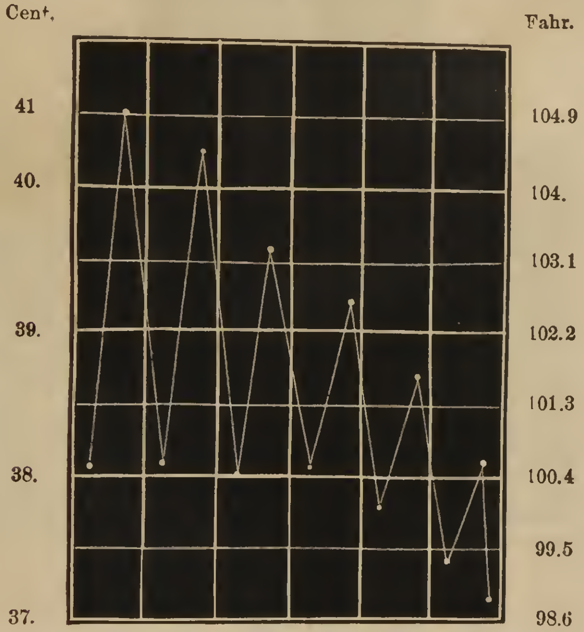
or begins to rise after a moderate or not truly febrile condition; or after some apparently favorable event; or after convalescence has made considerable progress; or it may set in after a fall of temperature to normal or below it, after a deceptive remission, or a short collapse.

In contradistinction to this *steady rise* of temperature, *rapid and extreme heights* may be reached in the pro-agonic period, succeeding to a high, moderate, or low previous temperature. In the first and most common case the previous temperature had reached 40°—41° C.=104°—105.8° F. or more, when a further rise of one to two per cent., = 1.8°—3.6° F. sets in. In this condition the pro-agonic stage is short, and imperceptibly merges in the death-agony (Fig. 33).

In the second case the final rise is often very considerable when compared with the preceding fall; yet the absolute

height is not altogether remarkable *per se.* In these cases, too, the pro-agonic period merges at once into the final agony (Fig. 34).

Fig. 30.

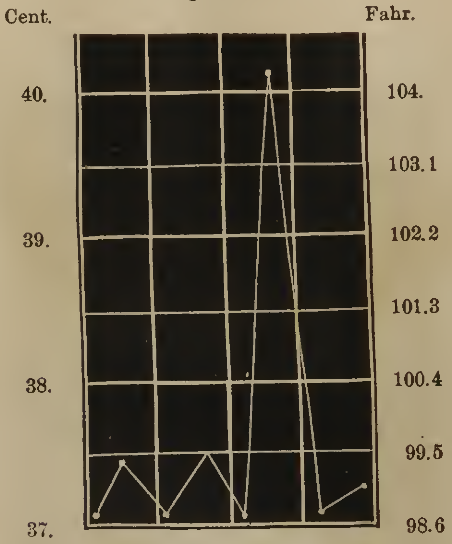


Lastly, in the third category, to which belong the hyperpyretic rises of temperature of fatal neuroses and of diseases of the brain free from fever, we may consider the whole period in which the temperature is rising as the pro-agonic stage. It begins slow, becomes rapid, and attains enormous heights (Fig. 35).

Far more common than the ascending form of the pro agonic stage, is that with decrease of temperature, the *descending type.* And it is much more important to watch this form, inasmuch as a superficial and partial consideration of the temperature only, might lead us to consider its decrease as a sign of amendment. "*A careful attention to the state of the pulse is our best safeguard against this gross deception, for in such cases, along with the fall of temperature, the frequency of the pulse increases in the most striking manner.*"

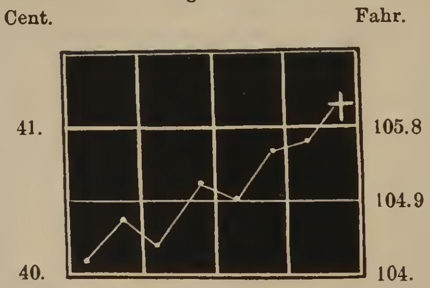
The pro-agonic stage may be short in this *descending type;* twelve hours to two days for a decrease of 1° C.=1.8° F., or

Fig. 31.



till the normal is reached. After this pro-lethal moderation of temperature there is a sudden rise in the death-agony itself. (Fig. 36).

Fig. 32.



In other cases the remissions are periodical, whilst interrupted by fresh exacerbations; there is irregularity by plunges, not the zigzag descent of lysis. This form occurs in the early complications of almost any disease, nervous affections, bad nursing, and dosing. At other times the rise and fall of temperature in the pro-agonic stage is tolerably regular, beginning with a fall

of half a day to two days and a half; rising again, even higher than its starting-point, ending in an exceptional rise or a fall. But in some cases (most difficult to prognose) the temperature pursues a descending course, whilst all the other severe symptoms continue; the patient dies whilst the temperature sinks

Fig. 33.

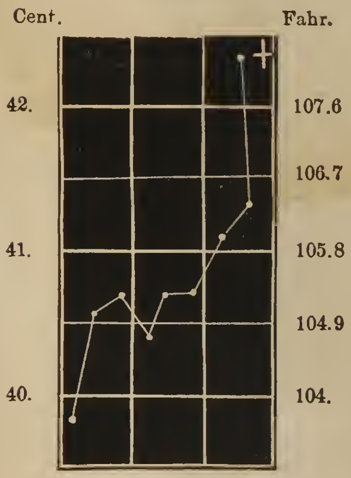
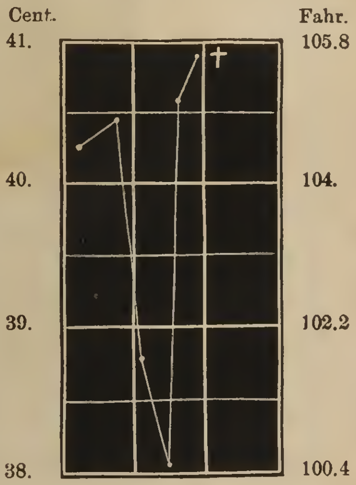


Fig. 34.



deeper or undergoes fatal perturbations, in which death takes place (Fig. 37); such is the course in basilar meningitis, typhus and typhoid fevers, especially in scarlatina, rarely in pneumonia; indeed, some cases seem as if fated.

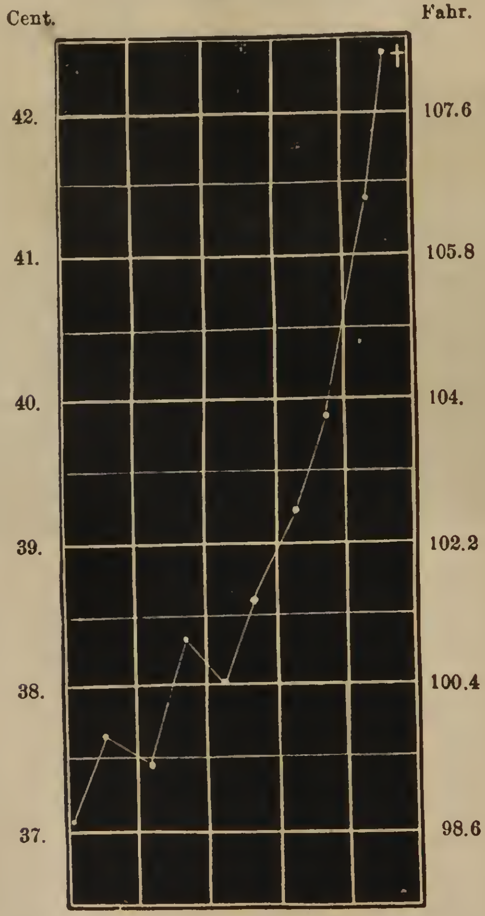
In rare cases the temperature is not modified in the pro-agonic period, where an unfavorable prognosis must be founded on other data, as a continuous quickening of the pulse independent of a stationary temperature. Lastly, the pro-agonic stage may be marked by extraordinary fluctuations of temperature repeating themselves several times in a day; there are deep falls and high elevations, in either of which death comes. Pyæmic affections are of this type. (See Fig. 38.)

In the *death-agony* the course of temperature is very varied.

It may keep the daily fluctuations without peculiarity, rather high if death occurs in the exacerbation, and moderate if in the remission. In patients from fever the temperature rises .5°

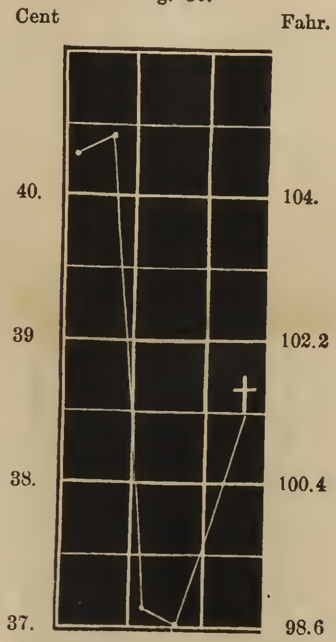
to 1° F. during the agony. If the fatal rise is moderate, there is a recession of a few tenths in the last hours, subject to two exceptions. In not a few cases, whether the previous temperatures have been febrile, normal, or subnormal, a *fall of temperature* occurs in the death-agony, which, when the preceding temperatures have been above normal, may be rapid and considerable; the patient dies in collapse. This happens in many consumptive diseases, inanition, hæmorrhages, cholera-flux, perforation of the intestines, etc.

Fig. 35.



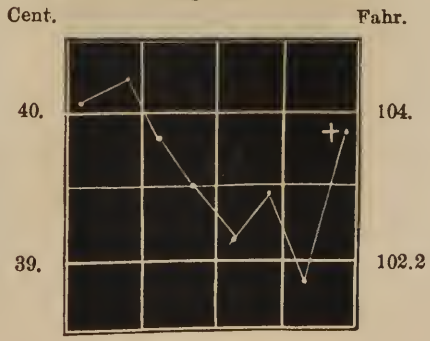
On the other hand, an *extraordinary rise* of temperature

Fig. 36.



occurs in the death-agony itself in patients who have shown a high febrile warmth, and in those, as well, whose illness has

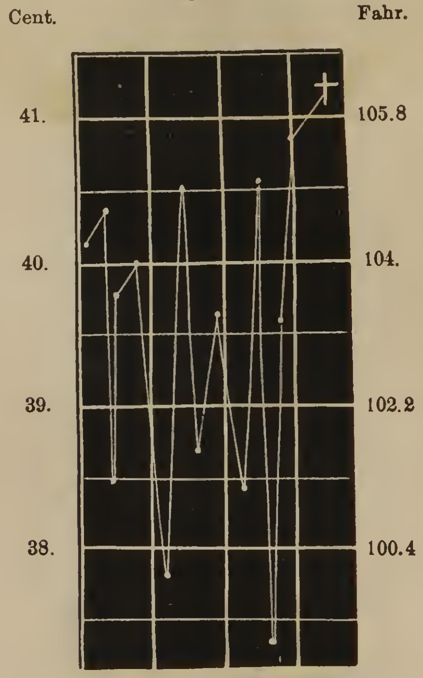
Fig. 37.



exhibited no elevation of temperature. This rise in the death-agony happens in malignant febrile affections whose infectious

character is probable, typhus and typhoid fever, in fatal cases of yellow fever, scarlatina, variola, pyæmia, septicæmia, and sun-stroke, and less commonly in pneumonia, measles, endocarditis, fatty degeneration, malignant peritonitis, erysipelas and rheumatism, osteo-myelitis and acute miliary tuberculosis. In these cases severe cerebral disturbance exists, but the main cause of the excessive disengagement of heat seems to be an extensive chemical process of a zymotic nature.

Fig. 38.



Moreover, there are diseases in which the affection of the nervous centres appears to determine the essential, or one of the essential disturbances: partly coarse anatomical changes; *e.g.*, meningitis of the convexity, softening of the brain, and the so-called central neuroses, tetanus, epilepsy, hysteria, etc., in which the temperature begins to rise for the first time in the last days of life, and very rapidly reaches enormous heights. In these cases, is the fatal rise an effect or the cause of the death-agony and termination? Senator, in Virchow's *Archiv*,

xiv. 412, thinks the latter is true, agony and death occurring because (from some cause or other) the temperature rises to a height incompatible with life. The matter scarcely seems so simple, though no other cause could be more effective than an enormous elevation of temperature.

The *moment of death* is not indicated by any special alteration of temperature; a moderate, even low pro-agonic temperature sinks most in the few last moments of life. When the temperature is high during agony, it often reaches at death-time a height it never attained before; or it simply falls to minimal diminution from the previous height.

After death, in the majority of cases, the temperature begins to fall. The decrease is more sudden when the patient dies with a low than with a high temperature. The rapidity of cooling, at first slow, increases as it goes on.

In many cases a small rise, seldom amounting to more than a few tenths of a degree, may be observed after death, and continues from a few minutes to an hour; then a short pause ensues, followed by a tedious sinking of temperature, which after a time becomes more rapid. This *post-mortem rise* occurs sometimes in cholera, and in cases terminating in hyperpyretic temperatures, either when the rise continued to the moment of death or left room for a short pro-lethal decrease. This phenomenon is based on two causes: The occurrence of death puts an end to the process of cooling by inspiration of cold air and by perspiration; and new sources of warmth are opened by changes in the substance of the muscles and *post-mortem* decomposition, two sources foreign to the living body, sufficient to more than compensate for the loss of heat from those of its sources extinct with life.

In cerebro-spinal meningitis, temperatures of 104°—111° F. have been observed just after death. Simon observed 104°—113° after death from variola. Assistant-Surgeon F. M. Mackenzie observed 106.2° F. in the rectum after death from cholera. (*London Hospital Reports*, vol. iii., p. 454. Note by Dr. W. B. Woodman. See also Appendix VIII., *f*.)

CHAPTER XIV.

TEMPERATURE IN SPECIAL DISEASES.

"A COMPLETE insight into the course of the temperature in disease can only be obtained by comparison of the curves of many separate cases. It is only thus that the mind awakens to the conviction of their harmony, and gains the faculty of finding itself at home in the manifold modifications and deviations of the temperature of the sick.

"The rules deduced from the *comparison of separate cases*, though derived from one's own large experience, are never complete, and, like empirical abstractions, fail to bear the *stamp of inevitability:* fresh experience may modify or overthrow them.

"To deduce the rules from *quantitative materials* would lead to delusive results. The true characteristics are not to be sought in the absolute height of the temperature of a given day, but in the orderly succession of the temperature in the whole course of the disease, or during a definite portion of it; in the rise to a certain height, and fall to a certain depth, at regular, occasional, or fortuitous times. A more statistical estimation of the curves obliterates the peculiarities of the course of the temperature, and a more numerical treatment of the mass of cases can only give a trustworthy answer to certain limited questions."

Wunderlich advises to look less to the *numbers* and more to the *form* of the wave-system. "Their comparison enables us to construct a sort of model-curve or standard measure of single cases. I am aware that the general rules, of which the wave-system is, so to speak, the image, can never attain to the concrete actualities of a particular case; but I have so constant proof—in the copious stores of material at my command—of the correctness of the principle these rules are founded upon, that I hope they do not caricature or contradict

nature, but will be of service to those interested in medical thermometry.

"In this *method of representation*, the types of diseases, and their principal varieties, are the only details to be admitted. In this course there is danger, I know, of considering *mere abstractions* as *special forms* of disease; of comprehending under the same name things which differ, and rudely separating others closely related; but there is no great danger that these abstractions will be misunderstood by those who use them as standard categories.

"The typical course of the temperature in many forms of disease is no mere speculation, but an acknowledgment of undeniable facts. It is only doubtful or optional how many diseases should be included in such a classification.

"Once the typical theory admitted, we are confronted with the idea that there are such things as *normal diseases.* The distinction (between normal and abnormal) was first introduced by *Rilliet* and *Barthez,* in their incomparable *Treatise on the Diseases of Children.* For them, the *normal course of a disease is such as represents the uncomplicated results of a specific primary cause in a previously healthy individual.* Above all other phenomena, the course of the temperature permits us to distinguish *what is normal and characteristic in the course of diseases, from what is abnormal in individual cases.* The fact that the *abnormal cases* may practically outnumber the *normal ones,* will not invalidate the value of the type for any mind familiar with the proportions of exceptions to law in other physical sciences. It is only necessary to remember that in different forms of disease the limits of the normal are sometimes boldly, sometimes faintly defined, and at other times merge obscurely into others; and that, though we recognize the *principle,* we cannot force all forms of diseases to conform to a given type."

(We will continue to treat of *the temperature in special diseases* in the order adopted by Wunderlich. Not in ignorance that there are better ones built from the stand-point of ætiology, nor that we are unmindful of the classification offered by Roger of the maladies: 1. With increased temperature; 2. With stationary temperature; 3. With diminished temperature. This is certainly a step towards *the clinical thermometry of the future;* but the would-be stationary land-mark includes pre-

cious patches already surveyed by thermography, and many more, which must be better known before they are assigned their place in a methodical plan. This subject of ours, *Human Temperature*, is many-sided enough of itself, without mixing it up with the problems of a new nosology.)

I.—Typhoid Fever. (Syn. *Enteric Fever*, *Dothinenteritis*, *Abdominal Typhus*.)

Typhoid fever pursues its course with unmistakable regularity, and next to the relapsing and intermittent, affords the best proof of the theory of types. However the course of particular cases may dissemble, yet it is impossible not to recognize, amidst their differences, the marvellous regularity of its course, the foundation of its type. And more: in this pre-eminently typical disease there is not a single rule which is not subject to exceptions; deviations may occur in any segment of its course, but they are neither so numerous, nor so important, as to obliterate the type.

But there are cases whose diagnosis remains doubtful, till recovery or death takes place, between typhoid fever and acute tuberculosis, basilar meningitis, epidemic cerebro-spinal meningitis, typhus, pyæmia, etc., and also localized diseases, like myocarditis, endocarditis, with ulceration of the valves, abscess of the liver, etc., all of which closely simulate the march of typhoid fever. Still more difficult is it to be sure whether the typhoid affection has not supervened upon some other. Thermometry cannot always solve these doubts; but it can decide some otherwise obscure points of diagnosis, such as certifying that the apparently typhoid is another affection, or that the typhoid really complicates the other affection; and it gives us the means and power of answering questions relative to the disease, and a standard for judging of the propriety of the answers.

To gain the full practical value of thermometry in typhoid fever, attention must be paid to the following points: A single observation, *per se*, is never sufficient; made at a certain time, however, it may contraindicate the typhoidal character. It demonstrates its improbability or impossibility when it shows a temperature of 40° C.=104° F. the first day or the second morning; when between the fourth and sixth day the temperature in a child or adult under middle age never reaches 39.5° C.=

103.1° F., and indeed if it has failed to do so two or three times; when as early as the second half of the first week considerable or progressive diminutions of the evening temperature are met with.

Contrarily, thermometric observations alone raise the suspicion or support the conjecture that typhoid fever is latent: in slight cases, when the course of the temperature does not depend on a local affection, the object of the complaint of a parent; in the first week or first four days of the disease, when the disease attacks one previously ill or convalescent. To decide upon the presence of typhoid fever, morning and evening temperatures for three days in the beginning, four to six in the fastigium, or as much in the convalescence, are necessary.

The temperature indicates the *severity* of the disease about the middle of the second week, rarely earlier. A single observation does not do it, a whole day's observation gives it; but two or three days are still better. It indicates, best of all signs, the *irregularities* in the course; the *complications* that no other means can detect; a *relapse* after the patient has begun to recover; warns of the *tendency* towards death; *regulates the potency* of therapeutic operations; shows the *tendency to convalescence* with great definiteness, etc.; besides the most important fact that a large thermometric experience in typhoid fever has rendered possible the knowledge of its course and the certainty of its diagnosis and prognosis, which were absolutely impossible with the previous means of observation.

The typhoid fever is characterized by a fever which lasts for at least three weeks (excepting extraordinary cases and those of rapid death, seldom lasting less than a week). The maximum temperature is seldom less than 39.6° C.=103.28° F.; more commonly 40°—41° C.=104°—105.8° F.; when hyperpyretic, rarely above 43.5° C.=110.3° F. Fatal above 41.5° C. =106.7° F.

The *daily course* is according to the intensity and the period of the disease. Either continuous with highly febrile elevations in very severe cases; or subcontinuous or continuous without great intercurrent elevations at any time in severe cases. It is remittent at the beginning of all cases moderately severe or slight; often at the height of the severe cases, and always at the beginning of convalescence. Altogether, the type of the typhoid fever is remittent (with sharp curves) during the period of recovery. Its course may repeat itself irregularly in many of the

severe cases, at critical periods, or by the operation of circumstances.

Accordingly the *daily average* on which the daily fluctuations are based, varies a good deal; in the *continuous form* with exacerbations it is 40.5° C.=104.9° F. or more; in the *subcontinuous* and continuous 40° C.=104° F. or a few tenths more or less; in the *milder remittent* about 39.5° C.=103.1° F.; in *slight cases* as low as 39.2° C.=102.56° F.; at the commencement of and in the convalescence still lower, in the former with sharp curves, 38°—38.5° C.=100.4°—101.3° F.

When the fluctuations are irregular, the *daily average* is uncertain, and affords no indications.

The daily *maxima* are included between noon and 11 P.M.: commonly between 4 and 7 P.M.

The *extent of the exacerbations* at the height of severe cases is very large; the rise begins between 7 and 9 A.M.; the curve is single-peaked with a broad summit (rarely two, three, four-peaked). From the third week on, the latter peaks prevail, and the single ones are more acute in the convalescence, thus narrowing the extent of the exacerbation.

The *rise of the multiple peaks* occur: the first between 9 A.M. and 4 P.M.; the second between 2 and 8 P.M. (often at 6); the night-rise is between 1 and 5 A.M. sometimes double, first at 11 P.M., second as above. The second of a double-peaked summit is the higher in the period of increase. The *lowest point of the remission* occurs between midnight and 10 A.M., oftener at 6, 8, and 9 A.M.; it is not very low, is very acute, lasts only a few minutes in recent and in severe cases, but increases in breadth with the progress of convalescence.

The *rise of temperature* is either gradual or sudden, a segment of it may be tardy, the remainder rapid. The *daily descent* is slow, effecting the form of an easel, rapid only when there are irregularities.

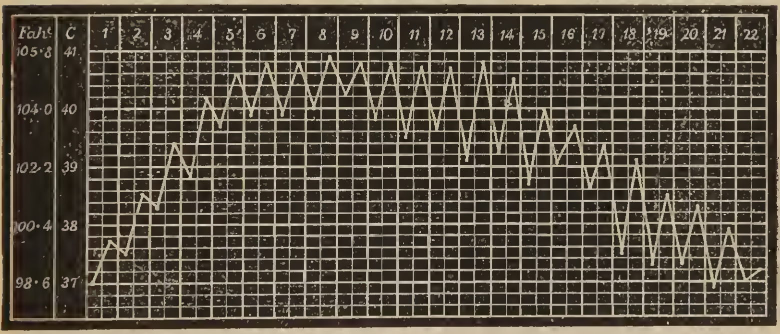
Typhoid fever has *two principal types* which agree at their *beginning* and *end*, but not in their *middle course*. This distinction is justified also by anatomical differences. One lasts but three weeks, and presents only slight infiltrations of the plexus of intestinal glands (plaques molles); the other lasts from four to six, sometimes nine or ten weeks, and presents extensive and successive deposits. In the former, the cure takes place easily by restorative, retrograde metamorphosis; the latter, on the con-

trary, needs a complicated process of elimination, to dislodge the deposits. Ulcers follow this dislodgment, whose healing is protracted. This complicated process of restoration affords numerous opportunities for ulcerous extensions, intercurrent febrile attacks, complications, and accidents.

There are cases corresponding almost to these typical descriptions, but the majority occupy a middle ground, approaching nearer one or the other type anatomically as well as pathologically. Exceptionally, the difference between the two types is marked from the beginning. The duration of the two varies in different places, and in the same place at different times. The mortality depends chiefly upon the *preponderance in numbers of one or the other type:* all conclusions as to the results of therapeutics must be subordinate to these rules.

Fig. 39.

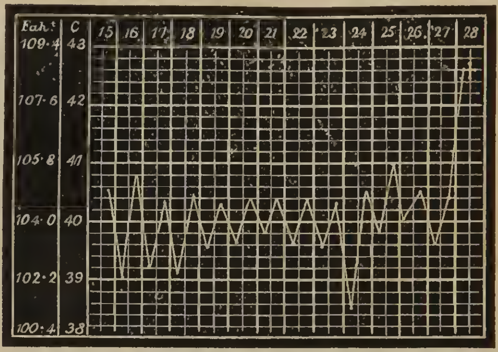
MILD TYPICAL TYPHOID FEVER.



An effervescence of seven days, a fastigium of seven days, and a defervescence of seven days; the antique trilogy. But simple as it looks, how difficult it is to make it out. Mere chance gave the opportunity to study the temperatures of the first days. That admirable and terrible progression pathognomonic of enteritis, Who is present to trace it *from the first day*, to mark its progression from morning to night till it reaches the characteristic evenness of the fastigium? If the physician is not called almost before the disease is felt like a *malaise*, the family has no means of information if they have no thermometer; the patient does not go to the hospital before his forces be-

tray him ; and then his observation begins somewhat as the following one.

Fig. 40.



Here the patient surrendered himself after two weeks of struggle. What struggle? In the absence of record of the untold fourteen days, we may surmise that he had passed through the ordinary crescendo, with remissions of the first week of effervescence; and seeing the great ecarts of the 15th and 16th day, we must suppose that they are the continuity-waves of a very stormy second week. Thence the temperature settled for almost two septenaries, with less than a degree of ecart between 39.5° and 40.5°. So far up from the norme! Yet note the sudden collapse of exhaustion the 24th day, as if nature had given up supplying ustion at such rate; but the impulse up was irresistible, combustion went on till death came in the middle of an all-devouring hyperpyrexy of 42.6° C.

After the consideration of the types comes that of the *individual circumstances, irregularities, and deviations from the normal course of the fever*, whose influence is almost null on the first type, but great during the second.

A relapse entering, just when the fever of the first attack leaves the patient, presents the most typical course of typhoid fever. The *regular course of typhoid fever* is met with in healthy persons, æt. 18 to 20, other circumstances being favorable. On the other hand, in children (the younger the worse), in people above 35 or 40, or sick of some other disease, in puerperal and scarlatina cases, and particularly in endo- and pericarditis, pleurisy, phthisis, hysteria, and parenchymatous nephritis, the typhoidal type is more obliterated.

The *course* of the typhoid fever is rendered irregular by simultaneous epidemics, by being very slight, or very severe, or extremely short, by injurious influences before or at the beginning of the attack, defects of nursing, mistakes in the treatment, undue muscular exertions, severe hæmorrhages, perforations of the bowels, complications of overwhelming severity.

On the other hand, a skilful treatment will often favorably *modify* the type.

At the approach of death the characters of the normal course *disappear*.

Yet, through these deviations and irregularities some indications of the *reign of law* are perceptible. In both regular and irregular cases, the typhoid fevers may be divided into *two well-marked periods*, which are distinguished by the thermometer with great certainty. The first corresponds to the *deposition and infiltration* (in the intestinal glands); the second to its *elimination*, and to the *restoration* and *repair* of the diseased parts. Both stages are marked by points at which an alteration of the fever occurs, not sensible to anatomic, but to thermometric investigation.

It is noteworthy that in the majority of cases which run a regular course, the duration of the separate periods corresponds in time with the division into weeks and half-weeks. The alterations in the course, and the transitions from one stage to another, occur at the beginning or end of a week, or in the very middle. This type is most decidedly shown in the brief and mild forms, and in the third or fourth week of the more severe ones (in the relapses).

Setting aside a period of *incubation* whose symptoms—disorders of the bowels, headache, febricula, and rigor—escape the observation, the *initial stage* of abdominal typhus runs its course with great regularity, whatever complexion the case may afterwards assume. During three or four days the temperature always takes the ascending course, rising about 1°—1½° C.=1.8°—2.7° F., from every morning till evening; and falls from every evening till the next morning about .5°—.7° C.=.9—1.3° F., till on the third or fourth evening a temperature of 40° C.=104° F. is reached, or a little exceeded. The formula of this ascent is nearly as follows:—

First day, morning, 37° C.=98.6° F.; evening, 38.5° C.=101.8° F.
Second day, morning, 37.9° C.=100.21° F.; evening, 39.2° C.=102.56° F.
Third day, morning, 38.7° C.=101.66° F.; evening, 39.8° C.=103.64° F.
Fourth day, morning, 39.2° C.=102.56° F.; evening, 40.3° C.=104.54° F.

The initial stage of typhoid fever very closely approximates this type; very seldom does any other disease show a similar pyrogenic course, which is of itself a decisive test for diagnosis. In other words, if the temperature of the second, third and fourth evenings is only approximatively normal; if the temperature of the first three evenings, or of two of them, is of the same height; if the temperature of two out of the first three mornings is alike; if the temperature of the first two days rises to 40° C.=104° F. or more; if the temperature retrogrades only once on any of the first four mornings and evenings; in every one of these cases we may or must exclude typhoid fever from our diagnosis; and contrarily, said diagnosis is the more certain as the course of the temperature of the first four days comes nearer to the above formula.

Meanwhile, exceptions must not be overlooked. The rise may be completed in two days, or protracted five; both foreboding a severe course, the latter a delay in the favorable turn (crisis or lysis) till the middle of the third week; the temperature may return to normal the second morning, and be succeeded by a greater rise the second evening; the rise of the first and second day being less, that of the third and fourth will be much more; the height reached the third and fourth day is not always 40° C.=104° F., but may be a few tenths less, or more by a whole degree, 41° C.=105.8° F.; when the typhoid fever is secondary to another disease its initial is obscure, often unrecognizable.

This first period decides nothing as to subsequent mildness or severity, and in the majority of cases escapes observation, because medical advice is sought for ordinarily later.

In the second half of the first week and the first half of the second, the course of the temperature is quite uniform, but cannot help the diagnosis. At this time the *maximal height*, 40°—41.5° C.=104°—106.7° F., is reached rarely more than once between noon and evening of the fourth or fifth day; meantime the morning temperature is .5°—1.5° C.=.9°—2.7° F. lower than the evening's; one remission may be accidentally even lower.

During the second half of the first week the daily maxima remain close to the maximum; the first half of the second week, though agreeing in the main with the former, shows a trifle lighter exacerbations when the cases will turn favorably, and the remissions become somewhat deeper; so that the fastigium divides itself into two segments, the first with more severe exacerbations and less average remissions, the second with more moderate exacerbations and more considerable remissions.

The *first stage of the fastigium* ends the seventh or eighth day (really from the sixth to the tenth). During it, one temporary diminution of temperature may occur, once in a morning and once in an evening, generally before the tenth day. This period may be mild or severe; nothing can be predicted from it with certainty.

Cases will occur with *an unusually mild course* of four to eleven days, with evening temperature at 39.6°—39.8° C. = 103.28°—103.64° F., possibly with intercurrent moderations; and morning remissions as low as 1.5°—2° C.=2.7°—3.6° F.; or the course appears to be cut short.

Early convalescences may be due to the mildness of the affection, to a judicious treatment, even to an opportune laxative; other cases occupy the normal time (three weeks), though all the symptoms are mild; and in others the fever recurs in consequence of new deposits, and runs new periods. We regard this as the probable course of the disease, though in the early recoveries, in the absence of *post-mortems*, the typhoidal character remains doubtful; and in regard to the protracted recoveries, we are not *certain* that the course of the typhoid fever *must* have a fixed duration, or *cannot* occur without certain symptoms reckoned as pathognomonic. But we can say that, in our time and our country, it is rare for a case of well-characterized typhoid fever to last less than two weeks and a half (unless by the agency of therapeutics); and even for a mild case to show a decided defervescence before the twenty-first day.

Meanwhile, it is quite possible that under these denominations, *abdominal typhus, enteric, or typhoid fever, etc.*, may be included two essentially different diseases, though both located in the glandular apparatus of the bowels: one, a general disease the product of infection, the other a local enteritis in

which the follicular apparatus alone is affected. What happens in scarlatina supports this hypothesis, in cholera also, where the epidemic induced by contagion is perfectly simulated by the simple cholera morbus. This obscure condition thermometry cannot clear up, but it adds the strongest light to the evidences of etiology, of circumstances, and of the remaining symptoms. For instance, if the temperature several evenings reaches the range of typhoid fever, without particular reason or bad nursing, the presumption is that it is typhoid. Even if the temperature is like it for a séptenary, or only a little below, all other symptoms conformable, æt. above 30, or an anæmic child, the presumption is still for typhoid fever.

However *characteristic* may be the fastigium, its information is no sure guide to those who have not had the opportunity of studying the initial period; and typhoid fever may then be mistaken for pneumonia, and *vice versâ*, especially where hepatization takes place slowly; for acute exanthems, typhus by the temperature in the fastigium (though ordinarily higher in this), cerebro-spinal meningitis, acute osteo-myelitis (which has the same fever course, but with local phenomena), acute tuberculosis, trichinosis (which has the same course of temperature), abscess of the liver and pyæmia (similar symptoms), intestinal catarrh (which has a lower range of temperature if the nursing is proper), influenza, under the same conditions as the catarrh.

Although thermometry does not always, but often, succeed in mastering these difficulties of the fastigium period, it permits us to exclude typhoid fever from the diagnosis in young adults when the evening temperature keeps under 39.6° C.= 103.28° F., and in all cases when, during the severity of other symptoms, the temperature sinks to normal. It confirms a typhoid prognosis in illness of moderate severity during the fastigium, when *previously healthy persons of youthful or middle age*, after being ill five days or a week, 'exhibit evening temperatures of 39.7°—40.5° C.=103.46°—104.9° F., or a little higher, alternating with morning temperatures lower by .7°—1.5° C.=135°—207° F.' (grave complications or gross neglect excepted).

If the fastigium mark 41° C.=105.8° F. or more, or if there is no remission, it is owing either to the severity of the case, to the want of proper care, to manifold mistakes, or to complications (rare at this period). Though extravagant temperatures are

rather against than in favor of typhoid fever, thermometric observations conducted for a few days may decide the affirmative.

In the *middle of the second week*, between the ninth and twelfth days, slight and severe cases show a well-defined difference.

In *slight cases* the fastigium is shortened, with or without a brief perturbation; the favorable crisis (on the tenth or twelfth day) shows the first decided morning remission; the second may be less marked, but those following increase at the same time that the exacerbations decrease in severity; the daily ascent begins later, the corresponding fall begins earlier; a decidedly descending direction is taken by the temperature, and the twenty-first day, if not sooner, the decrease of evening exacerbations shows the convalescence established.

When the conversion of the short daily curves of the fastigium into the slanting ones of convalescence happens during the second week, it is a sign of the mildness of the case, but no pledge against unforeseen dangers; it promises only that their sequel, less severe, may be averted by vigilance.

Less trustworthy is a considerable and early decrease of the evening exacerbations, so that they approximate the unlowered morning remissions; this is fraught with irregularities and fresh elevations of temperature.

The surest course towards convalescence is *increased morning remissions, succeeded by milder evening exacerbations*, so that in six to ten days the temperature approaches to normal, through a descending zigzag progression. The difference between morning and evening temperatures may thus remain the same, or increase by the greater fall of the remissions; but the daily differences become less through the steady fall of exacerbations, till at the end of the third week normal temperature and convalescence meet.

This regular course leaves no doubt as to the diagnosis. Catarrhal pneumonia and influenza recover similarly but quicker, without fever during the third week; cerebro-spinal meningitis and trichinosis, with high temperature and in remittent form, are more protracted and more commonly interrupted; and other affections whose recovering affects this remitting form, have not so high a fastigium.

Other varieties of defervescence (than the remittent) are less

common *during the third week.* Apparent deviations from these types are due to erroneous chronologic statements.

With this course of temperature *complications* are rare, unless induced by *epidemic constitutions.* On the contrary, *recrudescences* and *relapses* are frequent, particularly in mild forms. *Recrudescences* are initiated by a rise of the temperature or by an interruption in the descending course, rendering remissions imperfect and hastening exacerbations. On the contrary, *relapses* begin after the fever has left the patient, even during convalescence; they have a regular, and generally favorable course of twenty-one days, as said before.

A *severe course of disease* is predicted by persistent morning temperatures above 39.5° C.=103.1° F., and evening ones above 40.5° C.=104.9° F.; by the punctuality of the daily exacerbations, and by their prolongation beyond midnight, whilst the daily differences are slight, rendering the course subcontinuous; and when the minimum daily exceeds 39.6° C.=103.28° F. (lowest limit of typhus exacerbations); or when the temperature does not moderate sooner than the twelfth day.

All irregularities in the second week are suspicious, particularly no increase of the remissions, with almost standstill exacerbations, even if the morning temperatures are higher than the evening. 40° C.=104° F. in the morning, and 41° C.=105.8° F. in the evening, during the second week, with a tendency to a rise, is a sign of a severe course; and worst of all are apparently purposeless fluctuations, among which are *sudden decreases of temperature foreign to the course of typhoid fever.*

In severe cases *a complicated course* is particularly expected. The least dangerous is that in which (everything else being moderate) the evening exacerbation stands over 40° C.=104° F., and once above 41° C.=105.8° F., with morning remissions of at least 1° to 1 5° C.=1.8°—2.7° F.: the course going on till, or to the end of the third week, prior to any improvement.

Sometimes the moderation comes in this way: the high temperatures of the second week do not recur, falling about .5° C. =.9° F., with high fever and inconsiderable remissions; considerable remissions may be postponed to the fourth week, even in pretty favorable cases. Or the temperature may remain as high as in the second week or rise higher, during the third and fourth. The remissions are less than in the initial period, the

exacerbations higher, even exorbitant; the former at 39.5°—40°, even 40.5° C.=103.1°—104°—104.9° F., the latter to 41°—42° C.=105.8°—107.6° F., the mean daily being 40° C.=104° F.; the remission lasts one or two hours, and the exacerbation, thus extended, begins at 8 or 9 A.M., continues till midnight or even later, commonly describing two or more peaks.

Or, one irregularity may bring on another, resulting from the severity of the case, bad surroundings, idiosyncrasies, epidemic prevalences of an inflammatory character, like pneumonia. *Asiatic cholera* supervening, depresses even thirty-six hours before its collapse, and twenty-four before its characteristic diarrhœa commences: apyrexia being here a premonitory symptom. Intercurrent hæmorrhages, too, depress the temperature even below normal, but it soon rises again. The momentary elevation of temperature in the former cases, and the momentary fall in the latter, are not the sole effects of the complications; they, also, destroy the typhoidal type, and prove injurious even after they have been happily overcome.

Extraordinarily, considerable falls of temperature occur without known cause, without collapse, but with weakness of the cardiac contractions, enormous frequency of the pulse, delirium, automatic muscular movements, coma or extreme prostration, resembling the fall of temperature of the pro-agonic period. These falls presenting great danger, yet not always fatal, we call "pro-leth*oid*" or "pro-agoniform."

Unless death succeeds, all severe cases have this in common: the fastigium and the whole course are protracted; at tolerably well-fixed days a moderation, at others an elevation of temperature happens. The remissions seem to prefer the last days or the middle one of a week; the rises come immediately *before* those days or at the beginning of a fresh week. The commonest event is a striking rise of at least .5° C.=.9° F. or more, about the twenty-fifth day, happening in the middle of a well-settled remission.

At this stage the diagnosis is seldom doubtful, unless tuberculosis or cerebro-spinal meningitis be suspected (if the latter is epidemic, for instance). Altogether, every case so protracted and complicated is threatening. A height of 41.2° C.=106.16° F. leaves little hope but through a tedious protraction; at 41.4° C.=106.52° F. we see one cure out of three; at 41.5° C.=107.15° F., recovery is a rarity. Fiedler had two recoveries at

41.15° C., all the others and higher ending fatally. Wunderlich had a recovery at 42.2° C.=33.7° R.=107.825° F. during a rigor. A repeated rise to a considerable height, say 41° C.=105.8° F., increases the danger considerably. Yet these are better borne if the morning or intercurrent temperature is low, high temperatures with remissions being less dangerous than an almost continuous height. If the morning temperature exceeds 41° C. =105.8° F., death is almost certain. If the temperature is higher in the third than in the second week, let us take notice. All gross irregularities afford a bad prognosis or threaten further complications.

Severe cases rarely terminate by *favorable crisis;* oftener an *amphibolic stage* intervenes. This stage may intrude in cases previously slight; in aged persons, after previous ill-health, in recrudescence or relapse, after an irregular early stage, in patients exposed to injurious influences, having made great muscular exertions, etc. It commences in the third, sometimes in the fourth week, ordinarily preceded by an extensive remission, even by collapse, and exhibiting its apparently purposeless improvements and lapses. Its evening temperature is high, less so, however, than that of the fastigium; if not at one particular day, at least on the average. Intercurrently there are remissions, extensive but not steady, since favorable symptoms are followed by relapses; the falling of the temperature may degenerate into collapse, followed through great apparent danger by striking rises of temperature. Sometimes exacerbations of a stationary height alternate with deep remissions to or below the normal point, followed by collapse.

Although *defervescence* may establish itself through these abnormal alternations of a week or so, it is more common to see other *abnormalities* succeed these, viz., deep fall of temperature, or even collapse at the time appointed for exacerbation; *transfer* of exacerbations to the time of the remissions, and *vice versâ*, with no apparent cause, object, or danger; *complications* which raise the temperature and mask the remissions; and sudden great *fall* of temperature with hæmorrhage or perforation after a recrudescence of the course and a renewal of the symptoms. *Rigors* also set in with great rise of temperature, indicating pyæmia or septicæmia. This stage (amphibolic) lasts from three days to almost two weeks.

If the disease is tending towards death, the *pro-agonic* stage

often commences with deceptive and irregular depressions of temperature, quite discordant with the remaining symptoms. In other cases the temperature rises steadily, particularly in the morning, to 41° C.=105.8° F., followed by sudden elevations up to 42.5°—43° C.=108.5°—109.4° F., or above. Or a sudden deep fall is accompanied with extreme collapse.

The *death-agony* is not always preceded by a distinct preagonic stage; death may be as sudden as unexpected. In the death-agony and in the actual moment of death the temperature may be very low, highly febrile, or even hyperpyretic. If the temperature rises in the death-agony, it is with an increased rapidity at the approach of death, amounting to 1.5° C.=2.7° F. in a single hour. Death generally happens between 42°—43° C.=107.6°—109.4° F. *Post-mortem* elevations are met with, but last only a few minutes.

When severe cases tends towards *recovery*, this often occurs after a critical perturbation, lasting from a few hours to a few days. Oftener, a moderation of temperature prepares the ill-defined commencements of recovery. This *preparatory moderation* shows itself either in a single remission, somewhat deeper than others, or in a slighter exacerbation, or in a temperature slightly descending for several days; the type remaining subcontinuous, with a daily mean of about 40° C.=104° F.; lasting a whole week before any improvement appears. The *amendment* is generally announced by a great fall of temperature during remission time, even somewhat lower than will be that of the next day.

The beginning of *decided improvement*, in cases of moderate severity, often occurs about the middle of the third week, in severe cases at its end, in the middle of the fourth, or even later. *Defervescence* occurs after the remittent type, as in lenient cases, only it may last longer. It may be so excessive as to cause more than one collapse, or it may induce a stand-still, even a slight relapse. Sometimes its even course is broken by single-moderate or colossal fluctuations, by a solitary large rise, or by several such, between which the temperature of the morning is found normal: or it is interrupted by a subcontinuous elevation of temperature lasting several days. Actual *relapses* are often witnessed during the defervescence.

Sometimes instead of showing a clear tendency toward death or recovery, the amphibolic stage elongates itself in a *lentescic*

process (from *lentesco*, cleave, etc.), due to continuous ulceration of the bowels, or suppurative bronchitis, or tardy local affections, or to marasmus. The course of the fever, then, is chronic, with evening exacerbations and morning remissions which may reach the normal: duration illimited.

Complete *recovery* is admitted on the testimony of the temperature showing absence of fevers in at least two successive evenings; the thermometer is the final judge of recovery. However, during *convalescence* the temperature often falls somewhat lower, say 36°—36.5° C.=96.8°—97.7° F. in the morning, and under 37° C.=98.6° F. in the evening—a good rather than a bad omen. But very often this *period of recovery* is complicated. The least significant disturbance consists in a brief, though quite considerable elevation of temperature, caused by the first indulgence of animal or other food, or by some moral impression.

In grave, more than in slight cases of typhoid fever, febrile movements of one to three days will interfere with the march of recovery (simply retarding it). Thermometry tests these, and besides, the action of epidemics in protracting the disease. Frequently *true relapses*, or repetitions of the typhoid process, occur during convalescence, and can be recognized only by the temperature of the first few days (no other symptom being then pathognomonic). These relapses are to be dreaded if elevations of temperature above the norme occur eight days or more after the beginning of convalescence; though with timely care they are not dangerous, and offer the most perfect example of a simple, favorable, and quickly recovering typhoid process.

Various *hypostrophes* (ὑποστροφή, return, relapse) may occur here, that a fresh rise of temperature only can expose. On this account let us continue upon the convalescents the thermometric observations begun upon them when sick.

In *childhood*, particularly in the youngest subjects, the course of typhoidal temperature is somewhat irregular. The commonest of these irregularities is its extreme mildness; yet the temperature rises in the first days to a higher average than in adults; it passes more quickly into the remitting period, and defervescence is less protracted; but complications often occur, clearly indicated by the temperature. These irregularities of temperature render the diagnosis of typhoid fever very difficult in children.

In *people over forty* the temperature is lower than in younger adults, reaching in the exacerbations of the fastigium only 39°—39.5°=102.2°—103.1° F.; 40° C.=104° F. exceptionally, and in the morning it falls below 39° C.=102.2° F. The course, also, is more irregular. The fastigium seldom lasts over the second week; an amphibolic stage or complications protract the recovery; collapse often occurs; the temperature falls below normal during their convalescence, and in recovery oftener than in younger people. The beginning is often mild, even in fatal cases. Death occurs with a high, but oftener with a moderate or low temperature.

Anæmic people recover comparatively early, but are rather subject to complications, to hæmorrhages (not severe), to affections of the brain, lungs, parotid glands, and to bed-sores, more dangerous in them than in other people.

Previously existing diseases, which persist through a typhoid fever, render its course irregular, more severe, and obliterate its type, even to the death hour. Pregnancy and the puerperal state have this effect, but not by any means in all cases.

As to the effects of treatment on temperature:

The *cold-water treatment*, so-called, consisting in cold baths, douches, ice-bags, compresses, wet sheets, etc., is the most powerful. After each application it leaves a depression of about 1°—3° C.=1.8°—5.4° F. and more; six hours or so a febrile reaction follows, which rarely attains to the previous height; otherwise the kind, the extent, the duration of the application diversify exceedingly the results. Greater and more lasting are these results in complete baths and quickly repeated cold packs, especially for children; when the fever is mild, with a remittent course, the application is to be made at the time of the natural remission. Less, or no effect, is obtained from shorter applications of cold to grown-up people in earlier stages, in severe cases, in a subcontinuous or complicated course, during the ascending height or exacerbation. By the application of cold the type of the course is altered, remissions obscured, exacerbations *dislocated;* the course itself is rarely shortened, rather prolonged, but rendered milder. Also, when the type is subcontinuous it passes to the remittent, though anomalous at first, and further progress follows the remission. Other good effects are obtained from the cold-water treatment foreign to this subject. But as to its results, it diminishes con-

siderably the mortality, and has brought up cases considered desperate.

The early use of *calomel* (30 centigrammes=6 grains), and not so surely of some other laxatives, influence the course by producing remission. This is followed by a rise, not commonly to the former height; after which defervescence, apparently hastened, follows in a remittent fashion. Their recovery takes place earlier than in cases left to themselves, however mild. The early use of calomel delays the rise to the maximum height; if the maxima attain 40.5° C.=104.9° F., it has done no good; and the later it is exhibited, the less beneficial.

Digitalis (2 to 4 grammes = ℥ ss.—℥ i., or more) in divided doses, for several days in the second and third week, immediately moderates the temperature in a great number of cases, producing in the exacerbation a fall of at least 2° C.=3.6° F., which does not last more than a day. Then the temperature rises again, not so high as before in favorable cases, but remains stationary at a moderate height, with a much depressed pulse, whilst defervescence takes place as usual. Then the pulse recovers from its artificial retardation, and convalescence has meanwhile advanced.

Quinine (1.2—1.8 grammes=℈ i.—℥ ss.), divided in three doses, a few hours apart, powerfully lowers the typhoid temperature; more moderate doses may do it, but are not reliable.

There is no other form of disease in which so numerous investigations and facts have been accumulated as in typhoid fever; but none has an importance equal to this.

Liebermeister gives the following figures as the results of his own experience in the treatment of typhoid fever:

YEARS.	CURED.	DIED.	RATIO OF MORTALITY.
BY VARIOUS METHODS.			
1845–'53	444	159	30.4
1854–'59	643	172	26.7
1860–'64	631	162	25.7
INCOMPLETE APYRETIC TREATMENT.			
1865–'66	982	169	16.2
REGULAR APYRETIC TREATMENT.			
From Sept., 1866, all 1867,	339	33	9.7
1868	181	11	6.1

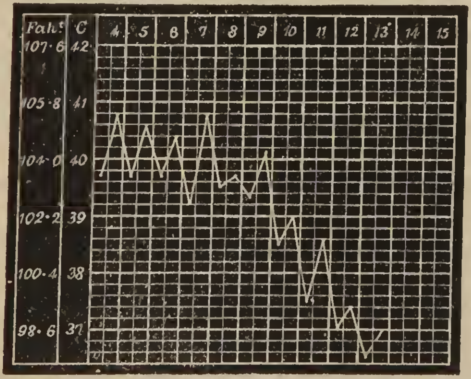
II.—Typhus.

(*Syn.: Spotted Fever, Exanthematic, Petechial or True Typhus.*)

As far as known by accurate but not numerous observations, the *fever in typhus* has a definite, typical character, most readily recognized in mild and medium cases. It differs from the typhoidal, with which, however, it has some analogies. It is shorter than the typhoid, and longer than all the rest of acute diseases which run a typical course. Its initial stage, its fastigium (with two periods), and its defervescence, are each characteristic. Observation of the course of temperature through one of those periods permits a diagnosis of great probability, and through any two of them of great certainty; it even gives the means of distinguishing the mild, moderate, and severe cases. Only in the latter alone is diagnosis sometimes almost impossible. Irregularities in the course, with or without complications, have not been yet characterized, owing to the small number of the observations.

Fig. 41.

MILD TYPHUS.



In the *beginning* (particularly with rigor), the temperature rises more suddenly than in typhoid fever, reaching 40°—40.5° C.=104°—104.9° F. in the first evening; on the next morning it recedes between the norme, 39.5° and 40° C.=98.6°—103.1°—104° F.; again on the second evening it is up to, or above 40.5° C.=104.9° F.; on the third to 41.5° C.=106.7° F.;

and on the fourth rarely under 41° C.=105.8° F., often above, even in cases which recover. At this period, neither thermometry nor the other symptoms are able to found a positive diagnosis. Particularly it cannot differentiate typhus from relapsing fever; but it can from typhoid, by its more sudden rise. Etiology (proof of infection) is yet, at this stage, the only foundation of typhus diagnosis.

In *moderate cases*, and such as take a favorable course, the temperature has reached its summit on the fourth day. Thence to the three days which close the first week, occurs the turning-point marked by a very trifling decrease of temperature. On the seventh or eighth day a greater remission succeeds, followed in its turn by a rise of a few days in the second week, which, in favorable cases, do not attain the maximum of the first. This happens seldom later than the ninth day, amounts to .2°—2° C.=.4°—3.6° F., lasts from one to three days, and slowly descends. On the twelfth day appears a *preparatory* remission occupying half a day or two mornings. A third and brief rise may succeed—*perturbatio critica*—terminating in true *defervescence;* unless this last has followed the first diminution of temperature of the second week, cutting short all intervening transitions.

In these slight cases the diagnosis remains uncertain during the fastigium, and is confirmed only by etiology. Thermometry offers a probability of typhus when it shows temperatures uniformly ascending in the second half of the first week, and not much less in the first days of the second; probabilities strengthened by the manifestation of cerebral symptoms, and by the unimportance of all other phenomena, which cannot of themselves found a diagnosis, but help to confirm it. However, thermometry used from the very beginning to the middle of the second week is able to give a valuable diagnosis. The only mistake possible would be in the rare cases when relapsing fever extends into the second week.

In *severe and neglected cases of typhus* the continuous ascent of the exacerbations continues through the first week, attaining 41.2°—41.6° C.=106.16°—106.88° F., or more; the remission of the seventh day is absent, the high fever persists through part or the whole of the second week; morning temperature at 40° C.=104° F., evening's 1° C.=1.8° F. more; the remission of the twelfth day is also absent or hardly perceptible; the

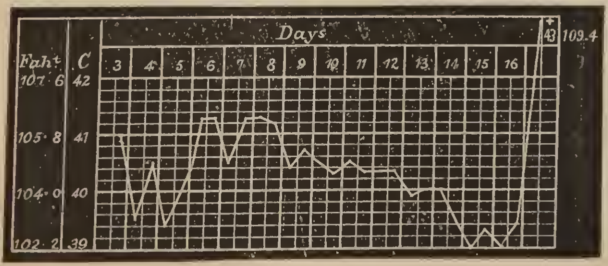
cases which will recover show a slight declination towards the end of the second week; yet high temperatures rule the mornings and evenings of the third week.

In these severe cases the diagnosis during the fastigium is more difficult than in the mild ones, especially the distinction from typhoid fever; for *severe* cases of typh*us* and of typh*oid* are more alike in the fastigium than *mild* ones. However, the daily maxima are higher in typhus, the tendency to remission is less; these are mere quantitative differences. But against this, rose spots may be copious in typh*oid* and scanty in typh*us*; the brain symptoms may be equally severe in both; liquid stools or profuse diarrhœa may be present in both: therefore let us understand the necessity of being careful in making a diagnosis.

The stage of *defervescence* is usually very characteristic in typhus. It is generally preceded by a short critical perturbation, a rise of a few tenths to 2° C.=3.6° F. or more above the preceding evening, greater in comparison to the morning; and it follows either in a precipitous or progressive descent. Where the critical perturbation is absent, the defervescence is very gradual. It generally appears between the thirteenth and the seventeenth day, seldom earlier. Postponed terminations are rare or doubtful. The defervescence of typhus falls sometimes in a single night from 40° C.=104° F. or higher, to normal; quicker than in typhoid fever; but never so low as in relapsing fever: characters which, in connection with the preceding course, serve to distinguish the typhus from other diseases.

Fig. 42.

FATAL TYPHUS.



Fatal cases of typhus announce themselves from the beginning by the enormous height of the temperature, 41.2° C.=

106.16° F., and even more. There is no remission at the end of the first week; death may occur in the second, or the case enters the third after some remission about the fourteenth day, which is soon compensated. Yet, even in fatal cases the temperatures of the third week are not so high as in the former, at least till the death-agony; the danger during that week being indicated, not by the height, but by the continuance of the fever. Just before death, and in the death-agony, the temperature rises constantly from 1.25°—3.6° C.=2.2°—6.48° F.; average 1.8° C.=3.24° F. During the agony I observed 40°—41°—42°, and once 43° C. = 104°—105.8°—107.6°—109.4° F. The course of the fever in typhus was first demonstrated by Wunderlich, and confirmed by Griesinger.

III.—Relapsing Fever.

(Syn.: *Typhus Recurrens*, *Famine Fever*, *Fièvre à Rechute*.

Relapsing fever shows itself in two forms, the *recurrent* or *relapsing* and the *bilious typhoid* of Griesinger. The course of the relapsing fever is typical; two, three, seldom four attacks run a continuous course of several days with a remarkable height of temperature, interrupted by intervals of several days free from fever. The bilious form, far rarer and less studied, runs a course quite similar. Yet, both in fatal and in recovering cases the second attack is often wanting, and the following apyrexia too; thus the peculiarities of the type are lost.

The disease generally *begins* with rigor and a rapid rise of temperature to 40°—41° C.=104°—105.8° F.; course continuous, interrupted by solitary *peaks* of exacerbation, of 41°—42° C.=105.8°—107.6° F.: two or three elevations in a day are rare. The *fever-paroxysm* lasts from three days to thirteen, and average from five to seven. A descending direction is first perceived at the end of the paroxysm, or if this is protracted, a few days before the critical period. This period is one of great and lasting fall, remissions as low as 38° C.=100.4° F.; the ensuing exacerbation slighter.

The height of the temperature immediately *before the crisis* is commonly 39.8°—40.5° C.=103.64°—104.9° F.; and the downfall now occurs with extreme rapidity (accompanied by

perspiration or not) from 3°—6° C.=4.4°—10.8° F. in an unbroken line in twelve hours.

According to Zorn, in the *bilious form* the fever is not so high, from 39°—40.5° C.=102.2°—104.9° F.; many cases prove fatal at the first attack; the fall is rapid too, turning sometimes the fever into *bilious typhoid.* This evolution follows fresh rigors, and is followed by copious perspiration; others have a protracted defervescence.

A period of *apyrexia*, free from fever, follows the defervescence; it lasts from four days to two and a half weeks; normal temperatures, with healthy daily fluctuations, are rare at this period; more common are undulated elevations.

After reaching its lowest point of defervescence, the temperature rises again from subnormal to normal, or higher: an ephemeral movement followed by a return to normal. Sometimes a fresh elevation may occupy the next day, and such fluctuations may occupy several days, or at others be entirely absent, or take place within normal limits. Thus the apyrexia is divided into two almost equal parts, the first dangerous, often mortal in the bilious form.

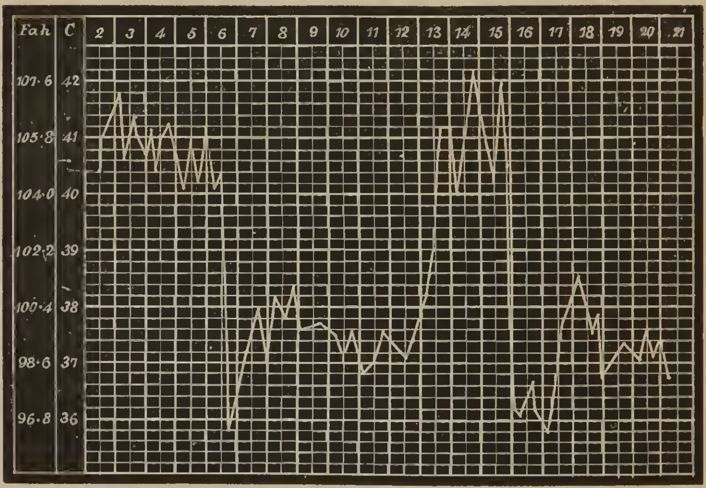
The *second attack*, or *relapse proper*, is oftener met with in the remittent form. Its beginning is quite sudden, rising in an abrupt line, in a few hours, at most in twenty-four, to 40°—41° C.=104°—105.8° F.; but still almost always remaining under the maximum of the second fever period. This second period is of three or four days, versatile in temperature which ascends or continuously, or interruptedly through deep depressions, or is marked by pointed paroxysms. The *peaks* thus formed (rarely more than one in a day) grow higher and higher, and the last represents the maximum of the second fever period, which is rather higher than that of the first attack, 41°—42.2° C.=104.8°—107.6° F.: hardly any other disease rises so high in cases which recover.

The intercurrent *remissions* are all inconsiderable but one (first or last), lower than the others by 1°—3° C.=3.6°—5.4° F. In the intermittent form the remissions last longer, and the paroxysms rise higher than in ordinary malarial (fever and ague). *Defervescence* succeeds, with or without perspiration, by a rapid and unbroken fall of half a day to 4°—7° C.=7.2°—12.6° F., even below the normal: isolated fluctuations are sometimes met at the end of this fall.

Relapsing fever generally terminates with this *second defervescence*, whose fall is greater than that of any other disease. Death may occur, even after the cessation of the fever; a third or even a fourth attack (second and third relapses) may appear, but are less acute, less exacerbated, less fatal.

Fig. 43.

TYPHUS RECURRENS.



Thermometry does not yet throw any light on the fatal terminations which occur either in the fiercest paroxysm, in extreme collapse, or in other conditions. In the only fatal case observed by Wunderlich, the second attack was followed by an amphibolic stage of fluctuations of a week; he died at 41.4° C. =106.52° F.

CHAPTER XV.

ERUPTIVE FEVERS.

These fevers are treated of as eruptive, though others are accompanied by eruptions, and called infantile, though adults are not exempt from them. They may succeed each other, or appear two at once on the same subject, or their eruptions be so mixed that temperature remains their best or only criterion. Unfortunately these temperatures, even their average maxima, have not been yet irrevocably settled; we give those we have in Appendix IX., *c*.

These diseases have another character in common, but not to an equal degree, nor of the same length; it is their incubation. This incubation has been proven for several of these diseases, as well as for others, to be composed of two periods: one of latency, in which the contagium sinks into the system; and that of invasion, in which it begins to come out from the body infected (likely by proliferation). Moreover, the latent period is proved to be innocuous, the invading infectious. (See Appendix IX., A, *a*, *b* and *c*; and B.)

How important, then, it would be to have this distinction extended to the incubation period of all the diseases communicable by a contagium, so that it would become possible to limit to very narrow circles these most murderous diseases, produce of infection (excepting the next in order).

I.—Vaccina.

Hennig, of Vienna, notes in the first days after vaccination an elevation of 0.2° Reaumur. On the spot of insertion a fall of 0.5° R. during about twenty-four hours; then a gradual rise, which amounts, at the end of the fourth day, to 1° R., by comparison with the healthy arm. Then begins the fever of gen-

eral infection, which goes up from .5° to 1° R. to the tenth day. the most notable feature being the local initial apyrexy caused by the penetration of the cow-poison.

Squires, following its effects farther, finds that it leaves a tendency to low temperatures for some time afterwards, particularly during subsequent eruptions, such as the vaccineous roseola.

II.—Variola, Varioloid.

The fever in variolous diseases exhibits *two distinct types*, corresponding to the forms of small-pox: a *brief continuous*, to varioloid, occurring chiefly in vaccinated persons; and a *relapsing type*, to the variola vera, which attacks oftener the unvaccinated.

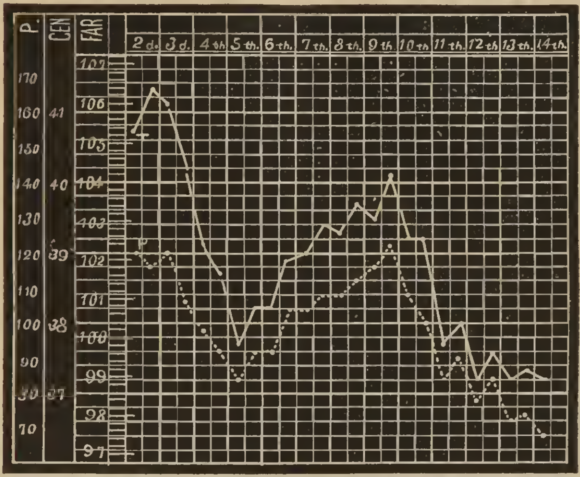
The *initial fever* has nothing typical. On the contrary, that of the *eruption-period*, taken in combination with the outbreak of the exanthem (even before this has any character), gives a perfect diagnosis. The initial temperature does not distinguish variola from varioloid, and affords no aid to predict the severity of a case; but its course after the eruption is full of import. That initial period is common to both types. On the first or second day its temperature is seldom below 40° C.=104° F., reached in an unbroken line, with rigor and shivering, or more slowly in the second evening, after a morning retrocession. In patients previously ill (phthisis, etc.), this rise may be lower and slower. The temperature may have attained its maximum the second day, or continue to increase till the fourth, with slight morning remissions. When the maximum of this initial stage is reached (41° C. = 105.8° F.), a fall of one day begins immediately. At this time the first traces of eruption in the form of spots may be noticed. This stage of two to five days is one of uncertainty; every day that passes without lung symptoms, renders pneumonia improbable; but if the fifth day passes without traces of eruption, small-pox is not likely.

Soon after the formation of the papules, *the temperature falls more or less rapidly*, from the second to the sixth day; if that downfall lasts one day it is continuous, if two or three it is interrupted by evening exacerbations. In this downward course the temperature soon reaches the normal point, and remains there, unless modified by complications.

The eruption of *varioloid*, when abundant, may be initiated by a slight febrile movement, but its most trusty character is a

Fig. 44.

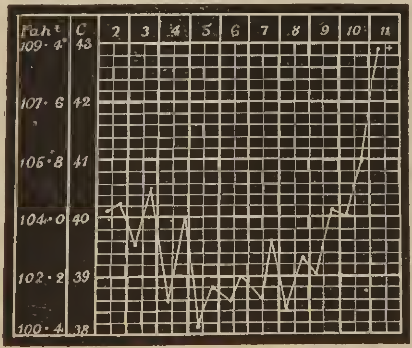
VARIOLOID.



fall of temperature. This fall distinguishes small-pox from measles, typhus, etc., and if it soon reaches normal, it characterizes also the varioloid from the variola vera.

Fig. 45.

FATAL VARIOLA.



In the *variola vera* (true small-pox) the falling temperature does not quite reach normal, but remains sub-febrile, or deci-

dedly febrile; or reaches normal, if at all, through tedious lysis. Then, with the congestion of the skin renewed in the suppurative stage, the temperature rises again. This suppurative fever is of indefinite duration, varied like the incidents of the disease, and its temperature is commensurate with its severity: a moderate variola hardly reaches 39° C.=102.2° F.; irregular fluctuations up to 40° C.=104° F. are dangerous; in fatal cases above 42° C.=107.6° F. may be reached at death; though a patient may die with a moderate temperature. In non-fatal cases the secondary fever lasts about a week; in favorable ones it defervesces gradually by lysis, or during the scabbing and desiccation time fever may continue even longer. Simon (*Charity Annalen*, 13 Bd., 5) found after death 43.75° and 44.5° C.=110.75° and 112.1° F.; and Roger, maximum 41°, minimum 37.50°, medium 38.75° C. Media of the first day 41°, of the third day 37.66°, of the fourth 38.25°, of the fifth 39°, of the sixth 38.75°, of the seventh 40.75°, of the eighth 38°, of the ninth 39.25° C., confirming Wunderlich's two prominent rules —a high start, and a recrudescence from the fifth day up.

III.—Varicella.

(Syn.: *Chicken-pox.*)

Varicella is inoculable with the contents of its own vesicles, which never produce variola, and the inoculation of variola, or, vaccination, does not prevent chicken-pox. However, the highest authorities cannot always agree in discriminating varicella from variola vera (Squire's *Infant Temp.*, p. 25). Its incubation lasts eight days. In about half the cases a prodromal period is manifested by a rise of temperature and a quickening of the pulse; later, morning remissions and evening exacerbations, restlessness, loss of appetite, redness of the mucous membrane of the mouth and fauces. It may be very slight, or quite severe, its temperature being proportionate to the extent of the eruption.

The illness precedes the eruption only by a few hours. In well-developed cases the temperature rises 38°—40°; high stage, two to five days; maximum of temperature attained in the first, oftener in the second half of the fastigium; morning remissions more marked after than before the maximum; defervescence complete in half a day.

IV.—Measles—Rubeola.

(Syn.: *Morbilli.*)

To Squire and Thomas we owe the thermometrical demonstration—in measles at first—of a stage of *incubation which cannot be recognized by any other means* (Wunderlich). Squire traced the contagion of measles prior to the appearance of the eruption in several subjects, and demonstrated it thermometrically. (See Appendix IX, *a*, *b*, B and C.)

In measles the fever precedes the exanthem, and accompanies it to its fullest development. Its typical character is pretty strongly marked. But as measles is subject to many irregularities from beginning to end, so is the course of its temperature; and since it is *the disease* of children and young people, whose temperature is the *most sensible to accidental influences*, it constantly exhibits strong variations from the type met in previously healthy individuals.

At a time in which the infection has been taken (the *incubation stage*) but in which no means of observation can recognize it except thermometry, Thomas notices the presence of a short preliminary fever-course (ephemera protracta), whose maxima are 38.8°—39.8° C.=102.84°—103.64° F., followed by a pause of several days.

The 'ensemble' of symptoms of the measles commences with its initial fever, which is complete in twelve to twenty-four hours, and whose rapid rise, 39.1°—40° C.=102.38°—104° F., is attained in the evening; 38.1°—39° C.=100.5°—102.2° F., being exceptional. Yet it is exceptional, too, for this first rise to attain the *maximum* of the whole course of the measles. How ever, the degree then attained is an index of the future elevations, which are wont to exceed the initial by .8°—1° C.=1.5° —1.8° F., or a trifle more. The initial rise is habitually followed by a downfall the next night, so that in the morning the temperature is normal, and seldom exceeds 38° C.=100.4° F., except in very anomalous cases; this depression may last a few hours, till night or till the next morning. The rise and fall of temperature are so rapid in this stage, that it looks like intermittent, but for the lowness; or it may be confounded with an ephemeral fever, but for the appearance of the ocular and pulmonary symptoms.

The *true eruptive fever* begins with a fresh rise of temperature, which will have but temporary remissions till the exanthem is fully developed. In most cases the eruptive fever is divided into two sections, a moderately febrile stage and a fastigium or acme.

The *moderately febrile stage* averages thirty-six to thirty-eight hours, made up of one or two exacerbations of 38°—39° C.=100.4°—102.2° F., not quite to the level of the initial fever: if two exacerbations, the second is the higher, the intervening remissions are not so deep as those of the initial stage, yet one of them may reach normal.

The *fastigium* commences early in the day, or late, leaving behind all previous height; if early, the evening temperature is higher, the next morning presents a slight remission, and the next evening the maximum. If the acme begins in the evening, the next morning the remission is slight or null.

In normal cases *the maximum of the acme* is contemporaneous with the fulness of the exanthem; in others it may precede it by the effect of some complication. The *fastigium* lasts from one and a half to two and a half days, and the *eruptive fever* is completed in from three to four and a half days; a course that complications may prolong.

Decided *defervescence* begins, according to rule, in the night, and ordinarily runs a rapid course, reaching the norme on the second morning, though one or two slight evening subfebrile heights may undulate the descent. Defervescence may also be protracted by bronchitis and other complications; when a case began irregularly its defervescence may do the same; and besides, trifling causes elevate the temperature of children. But sometimes a recrudescence of the fever is caused by an *after-stroke* or *recoil* of the exanthem; this may raise the temperature almost to the former maximum, but very transiently.

Complications alter the typical course of measles-temperature somewhat to their own type. Since fatal terminations, in cases of measles, are due to complications, the last temperatures are subordinate to these complications, not to the measles.

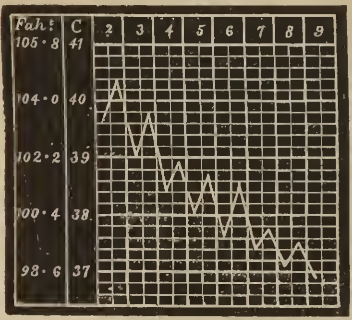
V.—Scarlatina. (Syn.: *Scarlet Fever.*)

Scarlatina conforms far less closely and regularly to its type than the previous diseases to theirs; yet there is an apparent

conformity of temperature in the cases which differ widely in other respects; evidently the pyretic deviations appear as exceptions to a rule. (See Appendix X., Mathematic course of scarlatina.)

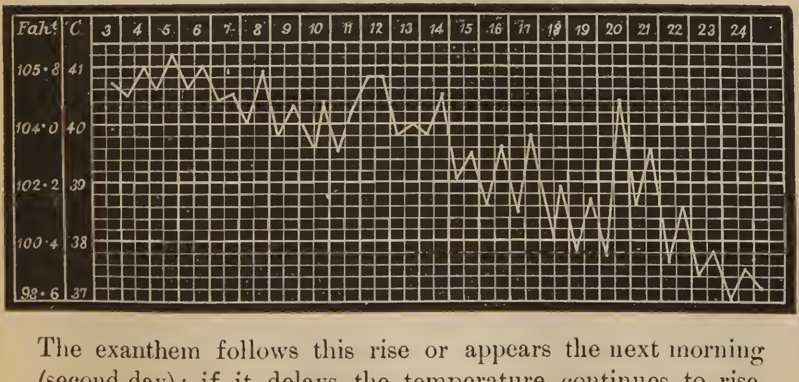
Cases of abnormally mild scarlet fever are tolerably common; so trifling their symptoms that they receive no medical care, and fatal sequelæ often ensue. But the course of the fever is often quite characteristic when the scarlatinous infection devel ops only a rudimentary disease, or even only an angina without any eruption.

Fig. 46.
MILD SCARLATINA.



In all cases of tolerably severe scarlatina the first symptom (with or without others concomitant) is a rapid temperature, steady rising, with shiver, to 39.5°—40° C.=103.1°—104° F.

Fig. 47.
PROTRACTED SCARLATINA.



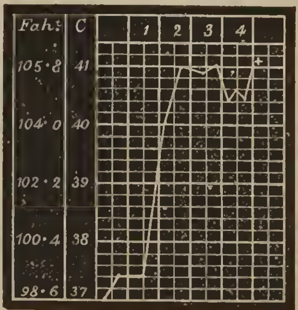
The exanthem follows this rise or appears the next morning (second day); if it delays, the temperature continues to rise,

with slight morning remissions, beyond the considerable height reached at first, till the exanthem has covered the whole body, and even till the parts first attacked grow pale. The duration of this invasion-stage is from half a day to four. The height thus reached is from 40°—41° C.=104°—105.8° F. As a rule the height is parallel to the intensity of the exanthem; though, exceptionally, the eruption may be slight with a high temperature, and, more rarely, the eruption copious with a moderate fever. The high ruling course of scarlatina distinguishes it from the other exanthematous affections, typhoid fever, etc.

Defervescence is not always alike. After a moderate exacerbation it may exceptionally fall and reach normal in half a day; but in most of the cases it requires three to eight days for its completion From day to day the temperature gets lower and slopes like an ease (Fig. 46), or through trifling remissions, falls by night, keeping up, or almost so, by day, till it reaches the norme. Seldom does this remitting defervescence liken itself to that of typhoid fever. The defervescence of scarlet fever may, like others, be delayed by complications (Fig. 47). A subnormal temperature may set in before the normal is assured, or a collapse. This form of defervescence is quite typical of scarlatina—at least not often met with in other diseases, except occasionally in typhus and catarrhal pneumonia.

Fig. 48.

FATAL SCARLATINA.



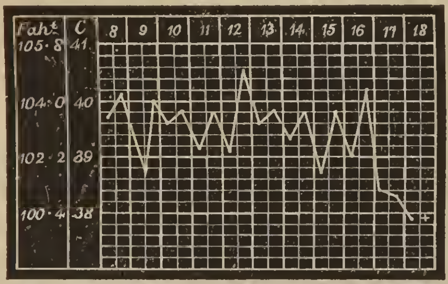
An *anomalous course* is not infrequent in scarlatina. The temperature may remain rather low—this does not exclude danger; or its descent may be interrupted by fresh exacerbations—this may be traced to some complications, but not always, and retards the recovery. There is also a peculiar typhoidal

condition, with persistent cerebral disorders, diarrhœa, meteorism, and enlargement of the spleen, during which (a fortnight or more after the fading of the eruption) the fever remains high, subcontinuous or remittent in form, yet generally takes a descending course.

During *convalescence* the temperature remains normal, unless affected by complications, fresh diseases, or a second eruption; therefore the persistence of normal temperature is a guaranty, contrarily a fresh rise is a signal of danger.

Fig. 49.

FATAL SCARLATINA.



In *fatal cases* the temperature is very varied, and ruled by the contemporary circumstances. If death happens during the eruptive stage, the temperature may range high, yet fall at the death-agony; if after the height of the eruption, either fresh elevations or fall of temperature precede death. Cases occur where the temperature rises enormously and suddenly before death; in one of Wunderlich's cases it reached 43.5° C.= 110.3° F.

VI.--Roseola.

Roseola (an hybrid between measles and scarlatina, which needs the experience of an extensive epidemic to distinguish its peculiar characters) generally, but not necessarily, shows a subfebrile or moderately febrile temperature during the eruption; higher temperatures depend upon complications, or the youth of the subject.

VII.—Dengue.

(Syn.: *Dandy Fever*, *Break-bone*, *etc.*)

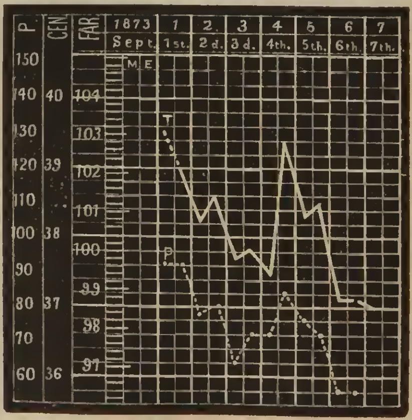
Apparently a purely eruptive, epidemic disease of the warm climates. By its eruption often mixed with other epidemics due to summer heat; looks like measles or scarlatina by its eruption, by its pains and swelling of the joints like rheumatism; by its glandular symptoms like typhus; by its mode of invasion like yellow fever, by its initial chill like intermittent, and by its periods like remittent.

Thermometry takes it out from that hybrid status, and sets it up as a malarial entity which has its own thermonomy, viz.: invasion too sudden to be noted previously to its acme. Two paroxysms separated by a short remission, and lasting from five full days to seven short. Remission the second, third or fourth day, remaining a few tenths above the norme. Exacerbation whose media average 39.5° the fourth or fifth day. Variation in the length of the stages which compensate each other, and keep the all pyrexia in the limits of time aforesaid. The pulse in dengue, unlike in yellow fever, remains concordant with the temperature.

There is its thermography by H. C. d'Aquin.

Fig. 50.

DENGUE.



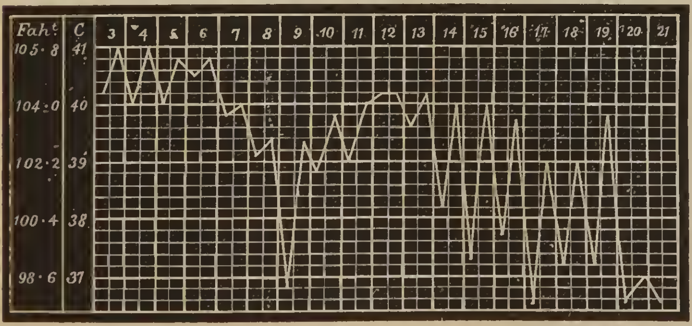
We can only refer to the excellent monograph of Aitken in

Reynolds' *System of Medicine*, which contains no thermometric observations, and will follow the condensed report of D'Aquin on the epidemic of 1873; though we dissent from both as to the character of dengue, which must govern its classification. They consider it as a *purely eruptive epidemic;* we think it will before long find its place where L. P. Brockett marked it,—as a *malarial disease*, with intermittent, remittent and hay fever, influenza, true pneumonia, etc., a group which will grow larger as our knowledge of ætiology will enlarge; in the meanwhile leaving to others the reformation of Nosology.

VIII.—Erysipelas.

Facial erysipelas is pre-eminently a polytypical disease, and in many cases atypical. This may be due to the fact that the same anatomical changes which bear that name are brought on by varied conditions, and may have varied significances; the erysipelas arising from the local irritation of wounded parts; that brought about by local predispositions; that connected with gastric and intestinal disturbances; the protracted, erratic, or vagrant; the kind analogous to an acute exanthem, especially the primary and spontaneous; that arising from pyæmic infection; that of glanders; that which is developed in marasmus;

Fig. 51.
FACIAL ERYSIPELAS.



that preceding death, have hardly anything in common but the local dermatitis and the name. The temperature differs widely in these cases. Erysipelas of other parts than the face is quite as atypical; we will find it among the surgical temperatures.

Excluding the cases free from fever, erysipelas *begins* with chilliness, by a rise of temperature to 40° C.=104° F., ordinarily reached in a few hours, rarely in a few days; after which the inflammation of the skin is noticeable. The *fastigium* is of the most varied character—from a single slender peak of short duration, to (oftener) high temperatures; continuous or subcontinuous, still rising with slight morning falls or to above 40° C.= 104° F., till the cutaneous process has fairly developed. There are exceptional elevations of 42° C.=107.6° F., and openly remittent and intermittent fastigiums.

The *maximum* occurs one or two days before the end of this fever. A trifling moderation succeeds, and a *critical perturbation* precedes the *defervescence.* This reaches the norme in twelve hours, unless an evening rise interferes, and puts it off to twenty-four. The cases in which defervescence assumes the *remittent form* (more rapid, however, than in typhoid fever) are those whose *fastigium* has been subject to considerable *daily fluctuations*, and whose dermal inflammation is still progressing. When the eruption ends with defervescence, convalescence follows undisturbed.

After a few days *a fresh and striking rise of temperature* may herald or accompany a new extension of the inflammation of the skin; this relapse lasts but a few days, and may be repeated several times: as long as there is eruption there is elevation of temperature.

In *fatal* termination death is accompanied with *high* temperatures; it was so in the cases observed by Wunderlich.

But we have not yet touched the question, what are the relations of local to central temperature in erysipelas? From the definition of the disease by the masters may be judged the discrepancies of their opinions in this respect.

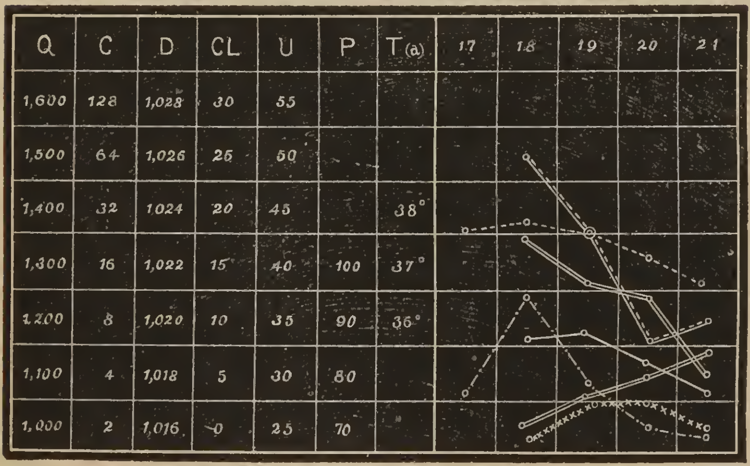
Erysipelas is, for Sydenham, a fever, an ebullition of the blood (our own effervescence); for Cullen, an inflammatory fever; for Rayer, an exanthematous inflammation; for Velpeau, a superficial inflammation of the skin; for Hosack, a pure inflammatory disease of the skin; for Watson, an eruption preceded by fever; for Niemeyer, an *erysipelatous dermatitis;* for Reynolds, an acute specific disease, characterized by a fever of a low type, and a peculiar inflammation of the skin; Trousseau, more circumspect yet, enumerated what it is not, but omitted to tell what it is. (*Clinique de l'Hôtel Dieu*, T. 1, p. 164.)

To conciliate the dermatous theory contracted by Niemeyer, with the daring generalization of Sydenham, will demand a great deal of labor. Happily, where our predecessors could surmise and conjecture upon the results of their sensorial observation, we are enabled to calculate the mathematical data furnished by our instruments of positive diagnosis; at guessing, genii could be misled; at reckoning, ordinary men may attain to wonderful accuracies. We have often comparatively taken the central and local temperatures, but were not allowed that frequency of observation necessary to come to conclusions.

I have instead given two cases recorded by myself *mathematically*, another by Molé representing *graphically* the alterations of functions after the manner of Lorain. (See Part II., Chap. II., § ii., *a*.)

Fig. 52.

ERYSIPELAS (MOLÉ).



My cases are mathematically represented in Appendix XI., and commented below:

The first case was of a ripe woman of greater physical expansion than strength, and subject to previous attacks. In her, the general fever was never as high in proportion as the local, though it preceded it; its daily differences being as small as one-tenth of a degree, never above one degree, averaging 0.72. In keeping with this remarkable moderation and uniformity of the general temperature, the pulse never rose above 112, nor fell below 72. Alone, the respiration, by its initial frequency,

averaging 23 during the effervescence, created an apprehension of pneumonia—then prevalent—but soon settled at 16½ in the defervescence. Quite in keeping with the higher height of local temperature was the formation and oozing out of purulent matter under the right eye, which left a persistent, thick scab. The defervescence, moderate as the effervescence had been, closed the seventh day at 2, apparently cut short by bilious critical evacuations, which suddenly brought the temperature to zero-norme, and the patient into convalescence with a ravenous appetite.

The second case—that of a primipara not yet completely recovered—was beset with more perils, still it ran its course of three septenaries with a regularity which gives it the appearance of one of these beautiful types created by the synthetic art of Wunderlich out of thousands of homologous cases; therefore, let us mark the mathematics of its evolution.

In the first septenary the effervescence is protracted to the fifth day; in the second, to the third; in the third and last it is subdued in forty hours.

In the first septenary the average of general temperature is 3.5; in the second, 2.42; in the third, 12.

In the first septenary the difference between the daily maxima and minima averages 2.35; in the second, 1.7; in the third, 1.2.

In the first septenary the local temperature averages 4.5; in the second, 2; in the third, 1.

The pulse, in keeping with the pyretic symptoms, averages in the first septenary 107; in the second, 90; in the third, 73 beats.

The respiration remained so near the norme that it seemed useless to record it.

The convalescence, which is yet in progress (28th of April), caused a rise of the temperature of 0.5 to 1.5, and a corresponding acceleration of the pulse.

As for the main question: In what relations of precedence, causation, duration, and reaction stand the general and local temperatures in the two cases herein reported . . . ?

In the first case, the fever preceded the phlegmasia by fully twenty-four hours, and overlapped it by thirty-six. In the second case, the initial fever reached at once its maximum, 7; and the local phlegmasia hers, 8 the second, and third day 8.5. In the second septenary the fever reached its maximum, 6.6, the first day, and the phlegmasia hers, 5 the second. But in the

third septenary the fever's heat rose only the second and third day; whilst that of the phlegmasia rose steadily from the first to the third day, after which it no more rose above zero.

These are mathematical facts which I have verified in several subsequent cases.

What can be deduced from them?

I will venture to surmise that—

1. If erysipelas did not show itself typical in its daily undulations, it proved to be endowed with septenary fluctuations which have the appearance of a type.

2. No less distinct than this septenary cycle was its division in two periods; one of effervescence and the other of defervescence; though, in the subsequent attacks, as the elements of ustion wore away, the days of combustion became less, and those of cooling more numerous.

3. One may also surmise, from the march of the local symptoms at the end of the second and at the beginning of the third septenary (see Case No. 2), that a complete resolution of local temperature, even to zero=health for several days, is no guaranty against a relapse; guaranty to be sooner looked for in the state of the general temperature, and particularly in the *differences* between the daily minima and maxima (see these *differences* in both cases).

This, to be sure, is a small contribution to the study of the relations of the general to the local temperature in erysipelas; but the thermoscope, more sensitive than thermometers, will help us to prosecute this inquiry.

IX.—Remittent Fever with Phlyctenular Eruption.

Syn.: *Miliary Fever.*

This disease is distinguished by an exanthem peculiar in form, situation, and course; by some typhoidal symptoms, by diseases of the respiratory organs, and by the course of the fever. A case observed was a continuous remittent, with evening temperatures above 40°—41° C. = 104°—105.8° F., and morning remissions of 1°—2° C.=1.8°—3.6° F. (no temperature taken the first week). From eight to fourteen days the temperature decreased by large fluctuations, as in typhoid fever; from day to day the remissions became more marked, the exacerbations

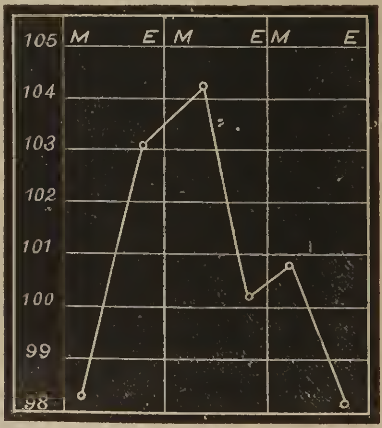
less, till normal temperature appeared first in the morning; but this course may be considerably protracted by relapses.

As described here after Wunderlich from a single observation it seems an hybrid, equally distant from the justly dreaded *bilious remittent of America*, and from the benign *miliary fever* of England and France.

X.—Febricula.

There are two courses of temperature known as *febricula*. One, longer or shorter, whose evening exacerbations rise very little above subfebrile, and only occasionally higher. The second kind includes brief fevers (*ephemera*) ending in recovery, in which the first symptoms of indisposition are accompanied by a rise of temperature of 2°—3° C.=3.6°—5.4° F., with or without rigor. The fastigium is of a few hours, or at most a day; as high sometimes as 40° C.=104° F., followed by a rapid fall, and restoration is sometimes protracted several days.

Fig. 53.
EPHEMERAL FEVER.

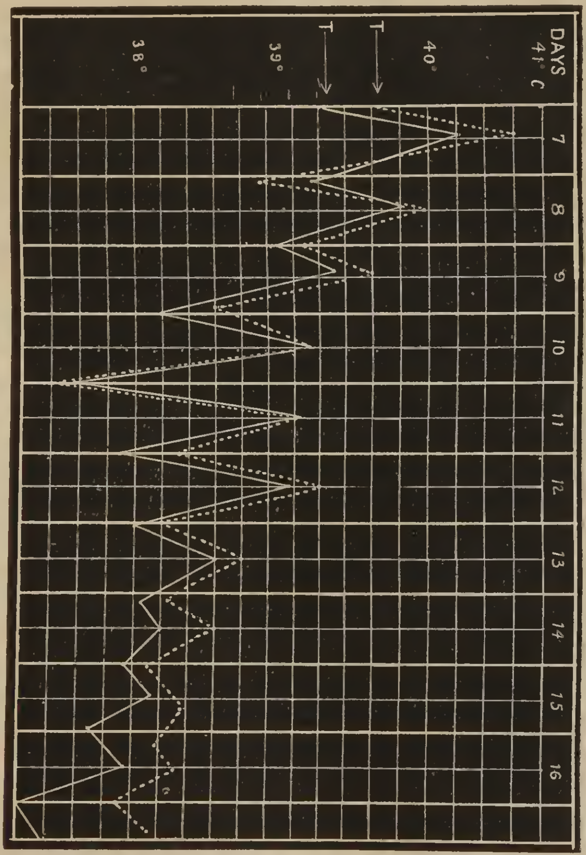


Ephemeral fevers occur in weakly or sick people, and women and children, without assignable cause; with rapid growth, dentition, exhaustion, or menstruation; they indicate the beginning or increase of some morbid process; are prelude to transient disorders of tissues, like the eruption of herpes on the lips; during the incubation of some infectious diseases; simultaneously with the spread through the body of a morbid

poison through the lymphatics, or with the formation of an embolic obstruction, or as a sort of reaction against severe chills, a complete drenching, powerful emotions, etc.

Fig. 54.

CONTINUOUS FEVER.



Wounds (from an operation, etc.) involve febricula, and the puerperal state too—of which in the next two chapters. (Here Wunderlich only treats of *traumatic fever* and *pyæmia*, to which we add the other *surgical* and *puerperal* temperatures.)

With *continuous fever* we enter one of the most complex problems of pathology—one which has been skirted in presence of the zymotic and eruptive fevers, but must be faced here, and before we reach the surgical, puerperal and malarial.

In fever-temperatures what is the part of the excess of heat-production and of heat-retention?

When are these excesses simultaneous or alterne?

What are the relations of the peripheric to the central temperature?

What Pathology and Therapeutics can conclude from the answers?

These questions, though distinct in many points, encroach on each other in several respects; so likely will the answers.

Also, though the latter may not be very satisfactory, they will aim at furnishing the means and methods to find out better ones.

Two laws of anthropo-statics are broken in fevers: one, *the balance of the production and consumption of* CALORIES; the other, *the equal distribution of* CALORIC.

It may be premised at large that in febricula, intermittent, and *fièvres d'accès* in general, the retention of heat, if not the sole, is the primordial and likely the main factor; and that in continuous fevers an over-production of heat, if not the sole factor, is the most constant and manifest till the end—either by restoration of the balance, or by bankruptcy. But how can these positions be verified when hypothetic, or determined when vague? If thermometry can do this it will be a great way ahead of the nosographies.

Thermometry has already ascertained that the consumption—consequently the production—of heat of a healthy man (of 54 kilograms) is hourly of 96 units of caloric, or *calories.* In sickness his temperature will rise above the norme by 1° C. for every 44.82 calories added to the normal 96. Finding this 1° C. (or more) above the norme, how can we find its origin, which is the pyrogenic origin of the disease? That is the problem.

It may relate to time: the temperature being first cold, then warm, and *vice versâ;* or warming and cooling, according to certain progressions. In these cases let us make as many *opportune* observations as the succession of temperatures warrants.

It may relate to place: being above the norme at the centre, and below at the periphery, and *vice versâ;* or too high or too low at both. In either case the observation is more complex.

In taking the temperature in reference to its localization, we must start from the principles already enunciated, and developed in Part II., Ch. II., §§ VII., VIII., and IX.: take the central

temperature in reference to the physiological norme—unless the patient has a known individual norme, for which see p. 14; and the peripheric temperatures by comparison with a healthy person who has remained in the same ambient temperature, at several points of the surface, and particularly on those points known as, or suspected of being the seat of especial retention or radiation of caloric.

Supposing we find the peripheric low and the central high, the sympathetic through its vaso-motor fibrillæ has constricted the issues of heat and of moisture in order to economize the latter for the coming emergency, the next pyretic stage. Then what is our duty? To prescribe the retarders of ustion, and to prepare a moderate reaction through the skin.

But supposing no chills, almost no remissions, the central and peripheric temperatures equally exalted, we first see that the sympathetic has equally lost control of the production and of the radiation of calor; we count the losses, so many degrees, each one representing every hour a waste of 44.82 calories, and we prescribe accordingly, v. z., so much of *x*... to supply the lost calories during *x*... time, and so much of *x*.... to retard both inward combustion and peripheric radiation, etc. Our therapeutics is a counterpart of the thermometric operations.

I must not omit, because I cannot explain, certain anomalies of ustion: some excessive, without or with hardly any apparent cause; others perfectly normal in the middle of the greatest functional or organic disorders (see Part II., Ch. XI., § ix., *b*). The former may be referred to certain nervous status, of which we know nothing except their compatibility with extreme temperatures both ways. The latter—unless it is a temperature in transit from above below the norme, or the other way—belong to the class called by Roger *neutral* (Part II., Ch. XIX.), which my experience taught me to class as *compound temperatures*, *i.e.*, temperatures in which several elements of high and low figures concur to simulate the point of health. These will be the matter of the next most interesting observations.

Febricula offers the less complicated, therefore the most favorable opportunities for studying these questions of anthropodynamism. So judged Winternitz in his *Nature and Treatment of Fevers*. Wunderlich is less explicit.

CHAPTER XVI.

SURGICAL TEMPERATURES.

A KNOWLEDGE of the body's temperature cannot be more useful in surgery than in physic, but its want is more sensible on account of the suddenness of many of its casualties. However, surgery does not show as large thermometric record as physic—not because it was not begun early, since Demarquay made valuable and conclusive observations as early (1835) as Donné, Bouillaud, Andral; but partly because the great field of surgical temperature, the battle-field, was rarely opened then, and mainly because the relations of local to central temperature, so important in surgery, can only be guessed at, or grossly appreciated, without special instruments.

During the American civil war (1861–65), thermometry was not practised enough to leave its traces in the otherwise so remarkable reports of the Surgeon-General of the U. S. A.; but during the Franco-German war (1870) it was applied on both sides, and gave interesting results, though much limited, we believe, by the want of special instruments.

The following propositions, and *faits à l'appui*, may eventually remain as the surgical trophies of this bloody contest.

A persistent pain keeps up the temperature above the norme.

A lesion of some extent—from any other cause than a firearm—even when it cures by first intention, is accompanied by an elevation of the general temperature.

Then, as well as after operations of secondary importance, Billroth found, a long time after Demarquay, a rise of 1°—1.5° C., which subsided to the norme the second or third day, when there was no accident nor complications. In case of complicated fracture without suppuration, the temperature continues higher a few days longer.

But if traumatism is caused by a conical bullet, or a fragment of shell, the temperature will be lower with marked stu-

por, and lower yet if the wounded was drunk at the time, or previously an inebriate, or above forty years.

Demarquay and Rodard observed 50 cases of lesions of the limbs, mainly of the lower ones (like multiple fractures with attrition of the soft parts by various projectiles), in which the temperature ranged from 37° to 34.2° C.; the lowest being caused by fragments of shell, the highest by bullets. None of them survived whose temperature was below 35.5° C., and even higher, if reaction did not take place in the five hours following the casualty.

From this somewhat large experience Rodard deduces that: (1) wounded whose temperature is below 35.5° C., must not be operated on, since they will certainly die; (2) wounded who will not, inside of four hours, give signs of a reaction commensurate to their *traumatic fall* of temperature, must be considered as seriously affected.

Poncet professes the same doctrines, and acted accordingly during the siege of Strasburg. Moreover, he gives the most precise rules in regard to the use of anæsthetics in operating on the wounded of this category (by projectiles). A great many of them are under the influence of alcohol, deep in stupor, and have lost much blood; cumulative causes of lowering (*abaissement*) of their temperature, and therefore cumulative reasons, too, for the surgeon to not produce these long anæsthesiæ which lower the temperature, and lead the wounded from sleep to death. Therefore, *do not use with them chloroform, above all do not add to it the chlorhydrate of morphine; on the battle-field beware of sleep.*

Demarquay and Dumeril, during experiments on the influence of pain, loss of blood, ligature, and anæsthetics, had discovered, in 1847–48, the propriety of ether and chloroform to lower the temperature. So that the surgeons of the war of 1870, French or German, and later experimentalists, like Boeckel, could only give more practical precision to the application of this principle to surgery. They did it somewhat in the terms above given, to which may be added: (*a*) Chloral lowers the temperature like ether and chloroform. (*b*) Other factors may enter into the apyretic action of anæsthetics, as the quantity of lost blood, previous fasting, etc. (*c*) A short anæsthesia produces an apyrexy of only a few tenths of a degree. (*d*) A longer one more in this proportion: (*d′*) when the ball of the

eye becomes insensible, 1°—2° C. of apyrexy; (*d'*) when the anæsthesia lasts half an hour, one must look for a fall of 2°—3° C.

In the wounds of the abdomen, if the peritoneum remain intact—even where the rectum and bladder have been hurt—the temperature does not deviate from its previously ascribed course in ordinary surgical cases; but if it is lacerated, depressions of temperature ensue. Here the figures on the thermometric scale are pathognomonic: if above the norme, they indicate that the sac is indemn; if below, that it is torn. In the former case surgery must follow its course; in the latter, examinations and operations are more than useless.

In extensive burns, which are among the casualties of war, the temperature falls frequently to 35°, 34°, and even 33° C., the lower in proportion to the area of the denuded surface, and to its proximity to the abdomen and thorax. Ex.: X——, æt. 23. Several contusions and burns of the chest and face; soon 35°; two days after, 34.6°; death some hours later at 34.3° C.

Similar lowering serves as a test of differentiation between strangulated hernia and impaction of fæces (*engouement*). It is also present in uræmia, due to urinary infiltration.

We have seen that after a wound, and subsequent operation, if there is no suppuration, the temperature will, in three days, come down to the norme. But this is not the most frequent occurrence. Oftener, before cicatrization begins, the wound undergoes more or less suppuration, which is fatal after an amputation, or the ablation of a tumor. This suppurative process is heralded by a fever.

I.—Traumatic Fever.

Will be the more considerable as the wounded parts were previously more healthy, particularly after the ablation of a limb. Its thermometric course needs to be well known, since it is too often the precursor of septicæmia and pyæmia, or purulent infection.

Seldom one day, oftener two or three, rarely five after the operation, anorexia is noted; the skin is hot, but one would look in vain for these chills which make the teeth chatter. The thermometer rises in two days to 39.5°—40° C.; keeps for two or three days at this height, with slight diurnal oscillations, and

comes back to the norme in as many days, by lysis. Therefore the traumatic fever is a typical one, having its effervescence in two or three days, its acme at about 40° C. with morning remissions, and its gradual defervescence, each of these three periods occupying the same time. When the maxima of the first two days are alike it is a better sign than when that of the second is higher. The length and the height of the fever have no connection. If the height remain considerable, a new diagnosis is necessary. The defervescence is expected inside of the third day. Age and constitution influence the course of traumatic fever.

On the other hand, an injury with considerable hemorrhage is followed by a proportionate fall of temperature, but reaction soon follows. If a chronic fever, consumption, Bright's disease, etc., existed before the injury or operation, the traumatic fever is more acute. Frequently the wounded experience on the fourth day a *secondary fever*, whose temperature is varied, being mostly the expression of constitutional *habitus*. These febriculæ are atypical.

II.—Septicæmia.

A morbid produce of city hospitals (hospitalism) which never enters an open country house, shows more threatening signs: inflammation is intense, and purulent œdema surrounds the wounds; tongue dry and parched, somnolence, no coma, rarely chills; the temperature rapidly rising, without or with feeble morning remissions, proceed by ascending oscillations till it reaches 40°—41° in adults, 39°—40° C. in old people. From this fastigium, which is attained in about five days, starts proagonic elevations, or hyponormal falls.

III.—Suppurative Fever.

Takes place during the long suppurations necessary to eliminate sphacelated parts, particularly in diffused phlegmons and after amputations. This is a quotidian rhythmic fever, with well-marked morning remissions, and with exacerbations about noon; the stronger as the wound is more extensive. But its fastigia do not take place at irregular hours, no more than those of septicæmia, unlike those of pyæmia. Moreover, the falling of the

temperature toward, and to the norme, precedes the fall of the eschars and the formation of healthy tissues; also warrants against septicæmia and pyæmia: its regularity makes its security.

IV.—Pyæmia,

Or *Purulent Infection*, distinguishes itself by different thermometric modalities. Irregularity may be called its type, since observations taken at regular hours, as well as every hour, will show variations whose evident disorder is characteristic, and even warns of its invasion. Then the daily maxima are met with in the morning or evening, or at any hour of the night, oftener in the morning, with vesperal remissions. The temperature rapidly attains 41°, even nears 42°, with chill and shake, and as swiftly falls below 37° under the action of diaphoresis; then settles at 38°—39° between these exacerbations; and lastly, the tenth day, or sooner, the oscillations become more frequent, their figures present large ecarts, to disappear only two days before death, when remissions cease altogether, and the index attains 42° C.

V.—Hectic Fever,

Presence of *Resorption* in suppurative osteitis, Pott's disease, etc., particularly in their last stage, is characterized by a course entirely different from the preceding suppurative fevers. In the hectic, the thermometer never rises above 39°, in the morning, and falls to 37°, or below, in the afternoon. During the devalescence the figures stand in the same diurnal relation, but lower.

VI.—Traumatic Erysipelas.

Quite often the cicatrization of a wound is interrupted by a specific well-known redness, and a continuous rise of temperature to 40° C., without the immediate remission which at this stage takes place in pyæmia. This is the period of effervescence of traumatic erysipelas; which is followed by a fastigium of two to four days, and by a rapid defervescence to 37°, or below. When there are *poussées*, each is accompanied by a sudden thermometric ascension, and a fall the morrow after. This pyretic movement distinguishes traumatic erysipelas from pyæmia.

I am not aware of the publication of any observations worth recording upon local temperature in surgical erysipelas; yet they would be precious to give a warning, at least twelve hours in advance, of the direction in which the *poussées* would spread, and to establish the mathematical relations of priority and of intensity between the local and the general ustion.

VII.—Tetanus.

The complication of tetanus in the wounded does not elevate the temperature *per se;* only in virtue of the muscular contractions. But in the proagonic periods, when asphyxia is produced by a paralysis of the diaphragm, then are seen those rises to 43°—44°—45° C., noted by Jaccoud and Wunderlich, and sometimes followed by post-mortem elevations of several tenths of a degree. (See temperature in central neurosis, Chap. XXIII., § iii.)

Some Organic Causes of Local Modifications of Temperature.

a. In fatty degenerescence of the heart the central temperature fell 1° C. or more.

b. In arterial aneurism the temperature is higher than in the indemn corresponding part. In artero-venous aneurism it is higher too, notwithstanding the impression of cold received by the patient. In compression, the temperature, at first higher, becomes notably lower. Ligatures produce the same variations.

c. In embolism, the temperature is normal upon the seat of the emboly, higher above, and lower below. One can readily understand the value of such topographic indications for the diagnose of recent local affections of this class. But how can these delicate indications be detected without very sensitive and accurate instruments?

(For other modifications of local temperature see Gaillot, *Essay sur la Thermometrie Chirurgicale*, and farther Chapter XX., § vi, *e*, *f*, *g*.)

CHAPTER XVII.

TEMPERATURES IN PUERPERISM.

It was once the custom in Burgundy to count to a boy an active campaign as two years of military service; and to a woman a successive pregnancy, parturition and nursing as two campaigns, or four years' active duty in the service of the *Res Publica.* This reckoning was not only just, and this assimilation dictated by a high sense of honor; but both seem, from our standpoint, calculated to impress the physician with the best appreciation of the female emergencies.

For women have their medical and surgical casualties very much like warriors: wounds, contusions, lacerations of tissues, hemorrhages, infections, pyæmia, septicæmia, erysipelas, shock almost identical. And mothers, besides, pine away after, and from wasting their norme in over-nursing, anxieties, sleeplessness, mounting unrelieved guards over a cradle, etc. Everything counted in, their casualties are fully two to one to the soldier's.

Sufficient reasons to bring together (*rapprocher*) the surgical and puerperal temperatures.

I.—Temperatures Prior to Delivery.

It is very well to say that pregnancy, its prodromes and its ordinary sequels are no sickness; but they are, at best, accompanied by so much uneasiness and suffering, and soon followed by so many accidents and dangers, that, *let it be* a physiological condition, and *let us* consider its most notable pathological effects on temperature.

The *influence of menstruation* is felt by a slight raise before, and a fall of temperature after (W. Squire), but insensible during the flow in health, and sensible in dysmenorrhœa and other functional disturbances (Wunderlich).

The *influence of pregnancy* affects the general temperature only after the sixth month (W. Squire); is purely local; the gravid uterus warmer than the vagina—independent of the warmth of the fœtus—by .25° C. = .4° F.; warmer than the axilla .3° C.=.5° F. Schröder found the excess of temperature of the uterus over that of the axilla, noticed in pregnancy, to increase in labor.

Before the labor pains no rise of temperature. *During the pains* a rise of .2° C.—.2.5° C., which falls back between the pains; otherwise the elevation of temperature proportionate to the intensity and quickness of the pains. The lowest temperature in those delivered at 11 A.M. In the first twelve hours Winkel found a moderate rise, and in the second twelve a corresponding fall. The average minimum of the normal lying-in period is estimated by Grunewaldt at 37° C.=98.6° F., and the maximum often exceeds 38° C.=100° F. A normal temperature after birth is no guaranty against subsequent puerperal mischief (Schröder).

II.—Temperatures toward the *montée* of Milk.

The temperature which has risen during the severe exertions of labor, 100-101°, remains there to the termination of the delivery, when it commences to decline, and is found the second day in the vagina 98.5° F., in the axilla 98.3° F. The fifth day: vaginal temperature 100.7° F., axillary temperature 100.3° F. (showing how little the tenderness of the neighboring full breasts affects the axilla). The ninth day: vaginal temperature 98.3° F., axillary temperature 98.2°.

In a case of abortion at two months, the temperature was found, the ninth day, vaginal 98.4° F., axillary 98° F.

The loss of blood, during and after labor, is not followed by the grave depressions of temperature which accompany and often reveal other hemorrhagics. "*La perte normale du sang dans l'accouchement ne fait pas baisser la chaleur*" (Quinquand). Notwithstanding the assertion of this author, *disturbances of temperature in the lying-in state generally accompany the formation of milk.* Once the milk formed, the temperature falls rapidly fully one degree, then slowly. But if milk is scanty, and the lochiæ correspondingly excessive, temperature remains,

as a warning, proportionately high. Some authors (Quinquand, Depaul) altogether deny this *milk fever*, and refer all the high temperatures of this period to the healing process of the lacerated *os uteri*. Without overlooking this cause of traumatic fever, we believe with Caseaux and Squire (and with our own medical senses) in the *fièvre de lait*, because the concurrent applications of the fever and surface thermometers, and particularly of the thermoscope, demonstrate the presence *in the bosom pregnant with milk* of an hyperpyrexia as capable of propagation through the general circulation, as that of a boil. (Appendix XII., *a*.)

III.—Traumatic Puerperal Fever.

Consequently to uterine lacerations, contusions of the small basin, and other lesions, *puerperal traumatic fever* sets in, of which the physician is admonished about the third day by the change in the countenance of his patient. Yesterday attentive and hopeful, to-day sunken in her couch, she shows a rise of temperature of 1°—2° C.; and supposing that there will be no complication, her case will run a course somewhat like that shown in Appendix XII., *b*.

The temperature in this fever consists in a rapid rise the second or third day to 39°—40.2° C., rarely preceded by chills, accompanied by pulse 110—113. This acme does not last, but comes down by a lysis of a week. In hospitals, Quinquand counts 100 cases of it out of 180 women; likely by taking in the milk-fever cases, whose identity he denies. But, as we said, the milk-fever is explainable by a specific cause, the congestion of the mammæ to prepare a new and energetic function; the which once established, the fever ends—not sooner, nor later.

On the other hand, there is no evidence that the *traumatic puerperal fever* is distinct from the gravest forms of *puerperal infection*, but in degree by its leniency, same march, shorter; same rise, though lower; same slow resolution, yet rarely complicated. If the identity of one of these forms of pathologic entities ought to disappear, it will not be by the immergence of the *milk-fever* (which has its own movement of temperature) in *puerperal traumatism*, but it will be by the latter entering the nosological frame as the mildest form of *infectious puerper-*

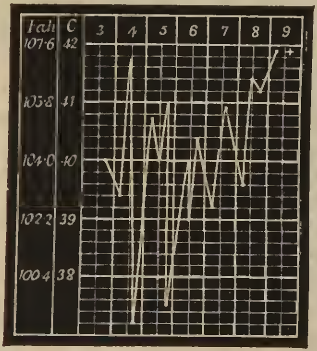
ism; a position identical to the one we have seen occupied in surgical diseases by *traumatic fever* in regard to *septicæmia* and cognate camp and hospital infections.

IV.—Infectious Puerperism. (Syn.: *Pyæmia.*)

The fever which accompanies acute severe lesions or the puerperal state, has its genesis in infection, and its commencement is sharply defined. It commences with a severe rigor, by an elevation of temperature often brought in a few hours to $2\frac{1}{2}°—3\frac{1}{2}°$ C.=$4\frac{1}{2}°—6\frac{1}{2}°$ F., and exceeding 40°—41° almost 42° C.=104°—105.8°—107.6 F. This first paroxysm takes an accuminated form..

Fig. 55.

PUERPERAL PYÆMIA.



After the temperature has reached its highest peak it begins to fall fully as rapidly as it rose, sinking from 2°—4° C.=3.6°—7.2° F. in a few hours, descending lower than it was before the paroxysm. As soon as it has reached its minimum depth, it begins to rise again; a *brusque* rise, more or less approximating the summit of the first paroxysm, is scarcely ever absent, subject to rhythmic repetitions, two or three in a day. Then follows a downfall of temperature after the manner of a rapid defervescence, coming down to normal, or pausing at 39° C.= 102.2° F. These pauses rarely last a whole day. Intercurrently, and more so towards a fatal termination, appear segments of a continuous or remittent course.

11

The *duration* of pyæmic fever is a week or so. In it death does not affect any particular temperature.

But *deviations* occur. Death may occur at the beginning of pyæmia in patients suffering from other diseases. The course may be continuous, particularly in traumatic pyæmia, or assume a zigzag shape, or affect a certain rhythm, or be protracted, and through successive improvements lead to death or to unexpected recovery.

It poisons the child (Appendix XII., *d*, *e*) as well as the mother (Appendix XII., *c*); is sometimes lenient, sometimes implacable. The gravest forms are those complicated (in order of frequency) by peritonitis, erysipelas, phlegmon, phlebitis, meningitis, purulent infection, gangrene, etc.

In the maternity of Munich, in 1861, of 80 women 41 died; of 33 children of dead mothers, 20 died; of 47 children of cured mothers, 12 died. Some physicians refer this infection of the infant to the epidemic constitution or locality; some, like Hecker, to the mother, already infected, previously to the delivery; and give as proof that of 51 infected children 24 died the two first days (5 still-born, 5 the first and 14 the second day); whereas the mortality diminished after the second day.

However, it has not been rare with Wunderlich to see the *infectious puerperism* begin with the mother after the flow of milk is established, and with the child after it has taken the breast a few days.

The complications come later, insinuating themselves obscurely, so to speak, into the general infection, without affecting its pyretic ascendency with their peculiarities. If the *puerperism* be lenient, its temperature, after reaching an acute acme at about 39.5°, begins an uninterrupted defervescence by slow lysis; weigh equally slow to recover. In fatal cases there is no acme proper, but a steady ascension towards proagonic temperatures, with very small morning remissions if any, and several daily chills at irregular hours.

On this question our first word will be the last. Though the puerperal state of the mother and the nativity in the child are no sickness *per se*, they both predispose to the reception of the germs of *puerperism* in all its forms and degrees; and the incipience of puerperism may be foretold, and its march studied by two methods: in the mother by comparing the temperature, the pulse, and respiration, and the daily composi-

tion of the urinary secretions; and in the child by a steady comparison of the temperature and body-weight. To eradicate puerperism, the hospitals and houses in which it has shown itself twice must be burned. (See *Compte rendu de l'Association Française pour l'avancement des Sciences*, 1873, p. 891.)

CHAPTER XVII.

CATARRHAL AFFECTIONS OF MUCOUS MEMBRANES.

The temperature of catarrhal affections of mucous membranes has no particular type. There may be no alteration of temperature, as it may be supranormal, subfebrile, or moderately febrile; if anomalous elevations occur, they are attributable to some malignancy, as whooping-cough, where it is safe to take daily observations. Little children, young and delicate people, already subject to catarrhal affections, present ephemeral extra-elevations which, protracted, end in hectic fever.

The temperature may assume an almost typical form in epidemic catarrh of the respiratory mucous membrane, when associated with gastric and intestinal catarrh, or with the nervous symptoms of influenza. Indeed, it is in the latter only that any considerable alteration of temperature is met with. It begins its ascent similarly to typhoid fever, though not quite so regularly. The same comparison holds good during the fastigium, which, however, is shorter; and during the defervescence of a remitting type (lysis), running its course more rapidly, closing it more punctually. On the other hand, in influenza the temperature may, after almost reaching the normal point, linger somewhat above it with greater evening exacerbations than is consonant with complete recovery. In presence of these pyretic symptoms the question arises: Is this a severe influenza or a case of typhoid fever? The approximate identity of the other symptoms in both diseases augments the uncertainty. In young adults, a range of temperature lower than in typhoid fever excludes it; otherwise the diagnosis must be deferred. In febrile gastro-intestinal catarrhs the course of the temperature is quite similar to that of influenza, but falls more quickly with good nursing.

I.—Croup and Diphtheria.

These affections are better differentiated in books than in nature; for in an epidemic we may find in the same local conditions, even under the same roof, amygdalitis, catarrh, croup, and diphtheria (besides bronchitis, pneumonia, broncho-pneumonia, and pleuro-pneumonia).

Diphtheria is the culminating term of croupal affections. It is local before being general. At least, its poison, either parasitic or chemical (A. Jacobi), enters the blood by the limited local surfaces of the fauces, but soon enters with respiration the pulmonary alveoli, whose immense surface is the chemical laboratory either of vital oxygenation, or of deadly toxication of the blood. By this latter process the whole body is soon poisoned as in septicæmia, unless *supported* and *disinfected.*

Wunderlich says of these affections: "In no other has the temperature so little significance as in croupous and diphtheritic affections: pharyngeal diphtheria, laryngeal croup, intestinal croup, dysentery, and diphtheritic and croupous puerperal endometritis. One may, however, regard very high temperatures in all these affections as adding greatly to the danger, though moderate or even normal temperatures do not give the slightest guarantee of a favorable termination. The high temperatures may even decline when the disorder unhaltingly goes on to worse and worse" (W. B. Woodman).

Roger, as usual, avoids theorizing, and gives eleven observations from simple angina to true croup, complicated by whooping-cough, broncho-pneumonia, diphtheric exudation of the wound after tracheotomy, etc. These complicated cases are interesting, but sooner blind than enlighten the question of temperature. To study the latter, all complicated cases ought to be set aside, and those proving to run an unmitigated course must be compared during the period of latency, during that of localization, and during that of general toxication; then, with the figures so found, we may expect to arrive at the elements of these compound temperatures which have defied the first calculations of our predecessors.

II.—Bronchitis, Influenza. (Syn.: *Grippe.*)

In the former the temperatnre is commensurate to the depth of the inflammation. If the large bronchiæ are alone affected, the temperature does not pass 38°, averages 37.50°. If capillary, it goes higher: 38.31° (Roger), 38.50° (Andral); maximum, 39° C. If the mercury continue to rise to 40°—41°, pneumonia may be looked for; if it remains about 38°, no complication to be feared. But the pulse and respiration were more disturbed than the temperature: thns in three children, two, four, and fourteen months old, T. 37.5°, P. 132, R. 64.

In grippe, or epidemic bronchitis, the mercury rises higher, maintains itself high four or five days, particularly in infants, 40°—40.6°, with an excursus of .8° from morning to night; so that it would look like pneumonia or typhoid fever, if the concurrent local signs of pneumonia were not absent, and if the movement of the temperature was not retrogressive, instead of having a typhoidal progression. As in all epidemics, the grippe borrows its innocuons or fatal temperatures from the prevalent constitution, besides those of its complications.

The complication with pneumonia is frequent, and formidable during epidemics in infants.—Obs. of Squire on *Temperature Variations, etc.*, p. 31. An infant three and a half months old, infected by his elder brother in the nursery, was noticed to sneeze January 23, and studied from the incipience:

Day of illness.	Date.	Rectal Temperature.		Pulse.	Respiration.	Remarks.
		Morn.	Even.			
1	Jan. 23	....	98.8	120	40	Temp. below the norme of this child.
2	" 24	....	101.4	135	50	Congh, harsh respiration, bowels relaxed.
3	" 25	101.7	....	130	60	Kept awake by incessant cough, high pitched rhonchi at scapula.
4	" 26	102.6	....	160	70	Dulness at the base and diminished expansion.
5	" 27	102.4	103.0	180	..	Crepitation.
6	" 28	101.0	102.3	160	60	Secretion commencing.
7	" 29	100.5	101.0	140	60	Large loose râles, dulness at left base.
14	Feb. 5	99.2	....	..	..	Expansion good, lungs healthy, some consonant râles in large bronchi.

II.—Pneumonia.

The diseases comprehended under the name of *pneumonia* have a manifold thermometric course, which, instead of being an anomaly, must be regarded as an indication of the wide differences existing in the diseases comprised under that common appellation, (and recognized after anatomical observations under the sub-names of "croupy, hæmorrhagic, serous, embolic, purulent, putrid or septic, lobar, lobular,") and of others whose anatomical characters seem identical, but whose other characters and etiology differ.

The term pneumonia is about as broad and unspecific as dermatitis; yet it is useful, because, while the patient is living, it is often impossible to differentiate from one another the different morbid processes which it covers with its generality, and which have not yet been clearly mapped out.

Thermometry, *itself and alone*, cannot decide as to the presence or absence of pneumonia, but it may demonstrate differences in the special forms which can be recognized by no other means; it can determine the degree of the affection and its danger; furnish a delicate standard of improvement, relapse, and effects of the medication; indicate the occurrence and persistence of complications; determine the completion of the processes; guarantee the certainty of convalescence and recovery; give warning of the continuance of disorders, or of the supervention of sequelæ; and indicate the intervention of pneumonia as a complication in measles, bronchial catarrh, whooping-cough, pulmonary consumption, and pleurisy. Therefore thermometry has only an *accessory value* in pneumonic affections, instead of a direct value as in typhoid fever, etc.

There are exceedingly rare cases of pneumonia running its course without any fever; and others, quite as rare, with a very moderate and almost momentary elevation of temperature, hardly 38.5° C.=101.3° F., for a few hours in the first or second day.

Somewhat akin to these are two *pneumonic febriculæ*, one with rigor, abrupt, rising above 41° C.=105.8° F., immediately succeeded by a rapid defervescence (ephemera with pointed peak). In the second, the highest point, 40° C.=104° F., is reached the third day only; the temperature declining at once (ephemera protracta). All these febriculæ are accompanied

with local processes, and are rendered dangerous only by their surroundings. They correspond to slight œdematous infiltrations, secondary pneumonias, mild inflammation of the lungs in young children, and phthisis in old and emaciated persons, etc. These forms may be considered as rudimentary copies of the two types of pneumonic fever: imagine the sharp peak of the first form of ephemera flattened out, it represents the continuous type with its sudden commencement and rapid end; imagine the ephemera protracta extended, we have the remittent type, with its gradual commencement and defervescence by lysis.

The fever of pneumonia shows brusque elevations and intercurrent falls of temperature. The *brusque elevations* in the course of the fever reach 41.5° C.=106.7° F.; when interrupting defervescence, 40° C.=104° F. The *intercurrent falls* occur in almost any form of pneumonia, whether slight, severe, or fatal, ranging from 1½°—4.5° C.=2.7°—7.2°, even 9° F., reaching the normal temperature, or below it, very rapidly, to rise again speedily.

The intercurrent decline of temperature happens in severe or slight cases, from the second day to the last of the defervescence, even to the death-agony; it may repeat itself more than once. This intervening downfall divides the fastigium into two periods, it may be regarded as a moderation in the attack; if several times repeated it may be a transition *to the remitting type;* but if it occurs abruptly and with regularity, pneumonia becomes *truly intermittent;* if less punctual it looks like the *pyæmic type;* if the low temperature persist and fresh elevations occur only after two or three days, we have the *relapsing form.* The fall of temperature before the death-agony is equivalent to a pro-agonic stage.

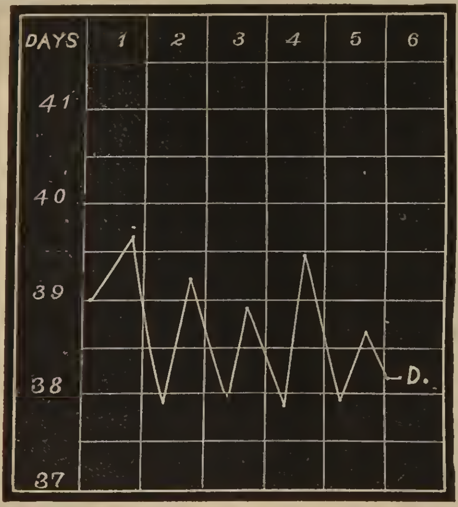
As for the causes of these falls of temperature, they seem to result from therapeutic measures, sufficient to perturbate, not to destroy the disease; or from local processes, terminating in one part, beginning afresh in another. It is not always possible, though it would be of the highest importance, to distinguish a pseudo-downfall from a genuine defervescence. The earlier the fall, or the less expected, the more must we look at it with apprehension as representing a pseudo-crisis.

The *continuous and subcontinuous* types occur chiefly in acute primary (croupy) pneumonia, more rarely in secondary;

beginning with rigor and an abrupt rise from 39°—41° C.= 102.2°—105.8° F. or more. There is often no other symptom, and only occasionally cough, pain in the chest, and dyspnœa. Auscultatory symptoms are rarer till the fourth day than headache, delirium, vomiting, loss of appetite and general depression, with strong fever. Meanwhile the temperature is 39.2° (mild)—40° C. (severe)=102.56°—104° F., with brief remissions of $\frac{1}{4}$°—1° C.=$\frac{1}{2}$°—1.8° F., and quickly returning exacerbations, often more than one of the latter in a day. This course lasts, as the pathological process in the lungs, from three to seven days, with variable or steady daily maxima and minima. Oftener the daily average grows higher till the afternoon of the third day, and thence declines a few tenths from day to day, even in fatal cases: this steady fall may be attributed to the medication or nursing. This downward tendency may be observed even in the fastigium.

Fig. 56.

CATARRHAL PNEUMONIA, WOMAN ÆT. 83 (CHARCOT)



Death may occur in low temperature; or in a pro-agonic rise, when accompanied with suffocation, to 40° C.=104° F.; with nervous symptoms to 41°—43° C.=105.8°—109.4° F.

In favorable cases the descending direction becomes visible as soon as after the occurrence of the maximum, which is

attained early; or after a downfall of temperature whilst the remissions become more striking and the exacerbations diminished.

Fig. 57.

LOBAR PNEUMONIA, WOMAN ÆT. 75 (CHARCOT).

On the last day but one of the fastigium *a pseudo-crisis* often takes place; great fall, followed by a considerable rise, precedes the *defervescence.* This generally begins in the evening, from the fourth to the tenth day or later, marches rapidly (in twenty-four to forty-eight hours) to its completion. The nervous symptoms may last through this period, severe bronchitis or acute pleurisy may hinder it; relapses also will occur; and finally, subnormal temperatures or collapse may set in till, through fluctuations, the normal condition is confirmed.

Many cases of pneumonia do not conform *so perfectly to the continuous type.* For example, the beginning may be less rapid and abrupt, lasting two days more till the temperature reaches its high level; or the temperature may remain lower than in well-developed pneumonias, or approximate the *remittent type* by great fluctuations, or the *intermittent,* or the *relapsing* by great falls; or the acme may be unusually severe and protracted into the second week, as in double pneumonia, or in the acute pneumonia of the upper lobes, or when

a whole lung is attacked; in which cases the acme is prolonged and its latter part is marked by fluctuations and amphibolism; then defervescence will be protracted and complicated with slight elevations of temperature. Accidental influences, idiosyncrasies, youth, old age, previous diseases, and complications, cause pneumonia to deviate from its regular course. Injudicious treatment is also a cause of deviation.

But the most decided influence on the course of the fever is brought about by a sufficiently copious *bloodletting* or a spontaneous *hæmorrhage.* Emetics, digitalis, veratria accomplish the same, somewhat more slowly, and nitrate of potash, aconite, etc., not so surely; but it depends on circumstances whether this sedative action will initiate defervescence, or induce a febrile reaction. Another cause of perturbation, not demonstrable, only surmised, is an infiltration approximating to a hæmorrhagic form or œdema.

A *remittent* course may occur in pneumonias almost at any period, developed from protracted bronchial catarrh, influenza, measles, etc., and is common enough in children and old people.

Its fastigium somewhat resembles that of typhoid fever, but seldom reaches its maxima or follows its regularity.

On an average, the duration of the *remittent* pneumonia exceeds that of the *continuous;* it rarely terminates by rapid defervescence, but is sooner effected by the morning remissions becoming greater, and the evening exacerbations growing less, in less time, however, than in typhoid fever. Remitting is more subject than continuous pneumonia to imperfect convalescence. Transitions between these two types are by no means rare. Whether there is bronchitis or pneumonia during a remittent course is judged by the acoustic symptoms; but pneumonia is highly probable with exacerbations at 40° C. = 104° F.

The differential diagnosis from typhoid fever is rendered more difficult if infiltrations of the lungs intervene; besides, cerebral, abdominal, and spleen symptoms are similar to the typhoidal; but in favorably progressing pneumonia the difficulty is less, and is overcome by about four days of thermometric observation.

A recrudescing fastigium occurs in the continuous as in the remittent type, when the hepatization of one part is followed

by the invasion of another. Unless death occurs, the convalescence of the remittent type differs from that of the continuous only by some irregularities and delay.

Sometimes the fever in pneumonia displays a *relapsing* course: much bleeding has caused it. These relapsing cases are allied to those marked by pseudo-crises with great apyrexia. Sometimes *erratic pneumonia* exhibits a relapsing form (erratic in relation to the rapid invasion and resolution indicated by means of physical diagnosis).

The *intermittent* course is closely allied to the *relapsing*, but has a more regular rhythm and more sharply defined apyrexia and paroxysms. This form is perfect during epidemics of intermittent, and is observable in embolic pneumonias.

The *intermittence* of pneumonias may cause two mistakes: one, to take first defervescence for the end of the disease; the other leads to the belief that the periodic symptoms are those of intermittent fever. However, the attacks of intermittent pneumonia become themselves soon weaker, and may terminate by simple absence of rise after defervescence, and by the establishment of convalescence. Wunderlich has never seen it end fatally.

The *abrupt course*, with its imperfect falls and fresh irregular elevations, resembles pyæmia, and is doubtless pyæmia due to the lungs' disorders, be they embolic or septic processes with multiple foci, whose course ends in death.

Pneumonias with *protracted course* display no particular character at the commencement of the attack; they are either continuous or discontinuous; but later, remissions occur, and instead of showing a tendency to recovery, the fluctuations aggravate and alternate with repeated collapses. Generally the daily maximum occurs at noon, the remission in the evenings, with a great tendency to collapse and an exacerbation about midnight. But this tolerably regular course only lasts a few days. If the patient does not succumb, the transition toward a state free from fever is long, gradual, and almost imperceptible.

Terminal pneumonia, *la pneumonie des agonisants*, does not necessitate an elevated temperature; which is brought on by accessory causes, not by the pneumonia itself.

(Let us compare this dogmatic form of judgment of Wunder-

lich to the French manner of viewing and handling the same subject. The contrast is too great not to be instructive.)

In pneumonia the invasion of heat precedes the chill for more than one hour; even before it is felt. Half an hour before the chill the skin begins to feel hotter. When the chill commences, an antagonism begins between the surface and the central temperatures, which may be figured on a graphic by two parting curves—one representing the central ustion reaches 39°, the other representing the chilled surface brought down even to 29° C. in half an hour. As the chill subsides the two curves come nearer again; this corresponds to a short improvement. But as the internal heat has not come down, the skin soon becomes dry and hot; the thermometer rises every hour, showing an increase of both external and internal combustion.

Then only pneumonia begins to give out its other signs and symptoms to our means of physical diagnosis, auscultation, percussion, etc.

The march of lobar pneumonia varies hardly from one case to another. That of the lobular varies in each case, because each partial inflammation gives rise to a new exacerbation. Therefore lobar pneumonia is a type, and lobular pneumonia is atypical.

The extent, the location, the form and the gravity of the pneumonia do not appear to affect its temperature; it soon reaches 40°, and then its maxima, 41°—42.5°.

Children attain their acme in about forty-eight hours; it is rather as high as that of adults and of old people; but in *infants* it does not reach so high. Roger notes also that one of the cheeks is often more red, more warm too, than the other; though this excess of coloration does not always correspond to the affected side. The same observation has been made in phthisis.

It lasts four or five days; the fever is continuous, with morning remissions and evening exacerbations, followed by a sudden defervescence to or below the norme.

The casualties from pneumonia do not appear—among children at least—to be in proportion to the elevation of the temperature; since out of eight deaths four happened when 40° had not been reached, and most of the cures after 40° had been passed.

But in old age pneumonia (mainly the lobar) needs be watched by the light of thermometry. Women, at the Salpêtrière, will

eat as usual, walk, make their bed, and suddenly recline on it, and expire; their temperature, if taken, could have given a warning; autopsy discovers a vast suppuration of pulmonary parenchyma. (See Fig. 56 and *Senile Temperatures*, Chap. XXI., § 1).

The relations of ustion, circulation, and respiration are remarkably concordant in pneumonia; excessive and protracted combustion being accompanied by concordantly frequent pulse-beats and breathings. In adults, 40° of pyrexy corresponds to an average of 110 beats. In children these relations are exaggerated 40° to 140°. The parallelism of ustion and respiration is almost constant, but not so mathematic; thus 40.25° may be found with 96 breathings, and 41° with 84 and 62 breathings in infants. Such a concordance of exalted functions is found in no other disease; in this it is expressed by the following average taken from forty-seven observations: T. 39.97°, P. 133, R. 52 (Roger).

This concordance is the test of differentiation of pneumonia from several diseases:—

From bronchitis, whose temperature, 38°, is in disaccord with the frequency of the respiration and the rapidity of the pulse.

From pleurisy, whose temperature does not reach so high, 40°, 41° in two days, the other signs being about alike.

From typhoid fever, in which the measured steps of temperature during the first mornings and evenings are typical, and in which the relations of the three great vital signs are remarkably discordant: T. 40°—41°; P. 65—95, rarely above 100, R. almost normal, sooner feeble, unless it is exalted and hurried by the interference of pneumonia.

IV.—Stomatitis. (Syn.: *Thrush, Muguet.*)

In *stomatitis* the central temperature is inferior to the local often by .5° C.; and averages in the axilla 37.8°, in the mouth 38°, with concordance between T. 37.8°, P. 108, R. 40.

In thrush the central temperature of seven children (Roger's observations), not proportionate to the extent of the exudation, averaged 37.85°, when it was not brought lower by the complication of sclerema, diarrhœa, or inanition. These *compound* temperatures are sometimes difficult to read aright. Squire,

reporting mainly from city practice, found some higher temperatures, and points out as a means of cure the removal of such articles of diet as the child cannot digest, and the advantage of neutralizing the acid state of the mouth.

V.—Parotitis. (Syn.: *Mumps.*)

The mumps *that children catch at school*, but not exclusively affecting them, have an incubation from two to three weeks, known to have extended two months, and proved to be contagious before their own apparition (W. Squire, Appendix IX., *c*). This kind appears to be a simple inflammation of the parotid glands, rarely extending to others. The fever, ordinarily at night, precedes their appearance; after which the rise of temperature, though generally moderate, is of the continuous type, with hardly any exacerbation, oftener with sweating, ascending from 2°—3° C., when the gland attains its maximum size. Then the gland does not shrink, but softens while the temperature comes down, by the same continuous process to the norme—the all movement being included in a septenary, provided no complication (like the earache) or accident occurs.

How different are the mumps, sequelæ of infectious fevers—and first how more sparingly contagious, but how much more fatal? They may appear at the beginning of grave fevers, being symptomatic; or at the end, being critic. Hippocrates judged them fatal when not suppurating; it is likely under the same apprehension that Baglivi would have them brought to that stage with the red-hot iron.

Their temperature—but is it not sooner that of the original disease?—has been very unsatisfactorily reported. I cannot give a better account of it than others, though I have treated a case, sequel to an epidemic of typhus from Beaufort, S. C., during the American civil war.

But when it came to me, it had already attained its fastigium, which ran almost two weeks at $\underline{2}$—$\underline{3}$ in the evening, with hardly any remission in the morning. I witnessed, however, the most interesting period—a defervescence of three weeks cut up by fresh rises of $.\underline{5}$ to $\underline{1}$, and corresponding to the metastasis of the mumps, to the left mammary glands, then to the right, and finally to the left testicle. Convalescence began at the end

of the seventh week, but the incapacity of mental labor and physical exertion continued fully nine months.

Moral depression, over-work, under-feeding, crowding, create or add to the proximate causes of infectious parotitis. In the siege of Paris many died of it; in a healthy village near by, out of 1,500 inhabitants, forty were struck with typhoid fever? . . . . (it is said, but likely typhus), out of which twenty had the mumps, and all died. No record was left of their temperature.

VI.—Amygdalitis. (Syn.: *Tonsillitis, Quinsy.*)

In tonsillitis, as in pneumonia, the fever and the local disorder are simultaneous; but in not a few cases the fever (resembling the prodromal fever of an exanthem) precedes by one or more days the development of the tonsillar angina.

At the beginning, fever is accompanied with rigor or strong sensation of chilliness. The initial temperature has not been sufficiently observed; it reaches its maximum commonly on the third day; in the parenchymatous form between 39°—40° C. =102.2°—104° F.; in the catarrhal under 39° C.=102.2° F. The course of the temperature in both forms is discontinuous during the fastigium. A critical perturbation may precede the crisis which happens between the third and the fifth day. A rapid defervescence is by far the commonest form in both kinds of amygdalitis; but if defervescence takes the form of lysis, low and high temperature may alternate for several days, and recovery be retarded.

VII.—Whooping Cough.

The incubation-period is pyrexical, often hyperpyrexical. It lasts a week or so, during which the temperature gives better warnings of the illness than the cough, whose character remains uncertain. This prodromic temperature is higher, and lasts longer, than that of the influenza; is often so high, before the cough is established, that it is a sufficient warning of the presence of a zymotic cause. As soon as the cough begins, after a week's incubation, the infection commences, at the same time that the temperature declines, to end in lysis, if not heightened by numerous complications.

VIII.—Herpes Zoster (Syn.: *Shingles*), *and other eruptions of the face and body, mainly in children.*

An elevation of temperature generally accompanies eruptions. Herpes zoster, one of them, may be taken as the pyretic type of those which affect children. It may be preceded by a chill, occurs during the process of teething, in the course of influenza, or under verminous diathesis.

The rise of the temperature coincides with the first appearance of the eruption, and reaches its maximum the third day. When the dermatose has attained its vesicular form, the temperature attains 101° F., and comes down to the norme as the vesicles begin to dry, though the integuments may remain red and hot—according to the testimony of the touch; but no mention is made of the control of this objective sensation having been verified by surface-thermometry, thermoscopy, or other means of positive diagnosis.

The pulse is quicker, but the breathing remains unaffected by the height of the temperature.

IX.—Meningitis.

Attacks of meningitis run their course without any fever, or with irregular elevations of temperature which are not characteristic; such is the case in chronic and partial (local) inflammation.

In children the range of temperature is almost as broad as that of life itself, 35°—42.5°.

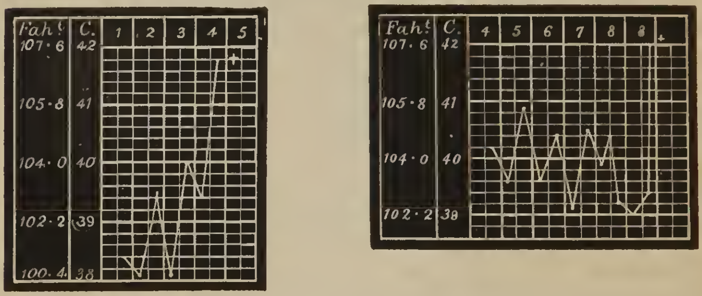
In the acute and more extensive (regional) forms, it is possible to lay down certain rules, not absolute, but adaptable, in the great majority of cases, to the three great modifications of meningitis: Acute, sporadic inflammation of the pia-mater of the convexity, or upper surface of the brain; granular (tuberculous) form, which has its seat more especially at the base of the brain, in the fissure of Sylvius, and about the cerebellum; the epidemic form, generally attacking both base and convexity, and extending even to the spinal cord (epidemic cerebro-spinal meningitis). These forms differ in their etiology, special symptoms, and course of temperature.

In *acute meningitis of the convexity* the fever sets in rapidly or slowly, according to the cause; the elevation reaches and remains above 40° C.=104° F., and grows higher in the death-agony; it becomes hyperpyretic at death, which comes in a few days.

In *granular basilar meningitis* (tubercular meningitis), the commencement of the morbid temperature escapes observation by being insensible, or immersed in that of previous disorders. Usually the course runs up as in typhoid fever, then displays isolated falls, even pauses of several days. When the fatal termination approaches the temperature rarely rises, generally falls, whilst the pulse is rising all the while, to the very moment at which the heart ceases to beat.

Figs. 58, 59.

ACUTE CEREBRO-SPINAL MENINGITIS.



Here ranks the combination of the two forms which we call the *scholar's meningitis.* It overtakes the college student whose head reclines on a desk ten or twelve hours a day, whose brain is kept in a constant state of orgasm, which calls more blood to the meninges than they can circulate without congestion at first, soon followed by serous deposits soon organized. These organisms pressing on the brain cause stupor, then collapse, soon ending in coma or fits; unless in few cases the victim of this gross ignorance tediously recovers, living behind all his virtualities. (See Part II., *Lessons from Orleans.*)

Epidemic cerebro-spinal meningitis, the *tetanoid fever* of Rodenstein, with identity of anatomical lesions, may present widely different symptoms, and varied courses of temperature, from *meningitis* proper. But the materials at command are too scanty to formulate the latter. From the observation of about thirty

cases Wunderlich distinguishes three special fever-courses. In severe, rapidly fatal cases it is similar to the affection of the convexity, it persists, continually rising till death at 42°—43.75° C. =107.6°—110.75° F., and once, three-quarters of an hour before death, to 44.16° C.=111.48° F. Relatively *mild* cases have short fever with considerable elevation in contrast with a quiet pulse. The course is discontinuous, recovery does not take place by crisis but by lysis; as the temperature approaches the norme the pulse begins to quicken. Once in a while after defervescence, in the midst of apparent recovery, a relapse sets in, the temperature rises rapidly toward the end just described. Other cases are more protracted; the height of their temperature shows manifold changes, depending upon bronchial, pulmonary, intestinal, or serous complications. The curves greatly resemble those of typhoid fever, less their regularity, more like it in its amphibolic period; or resemble the fever of phthisis. Defervescence, rarely rapid, takes place by lysis. The rise or fall of the final temperature depends on the immediate cause of death.

X.—Pleurisy, Endocarditis, Pericarditis and Peritonitis.

In simple pleurisy the temperature is less than in pleuro-pneumonia, and in the latter less than in pneumonia, in the proportion of 40°—40.25°—41°, and even above. In pleurisy thermometry gives the most precise indications in regard to the intervening processes of empyema. Its formation is accompanied by an elevation, its resorption by a decline, and each new *épanchement* by a fresh rise of the temperature. But if the initial course has been very high, and continues after the first septenary at the height of 40°—41°, not only there is *épanchement*, but it is no more serous—it has become purulent.

The majority of inflammations of the serous membranes present, according to Wunderlich, no typical character, and may run their course with or without elevation of temperature. Associated with another disease, they retard its defervescence, and otherwise cause irregularities in its pyretic course.

In the temperature-curves of serous inflammations which Wunderlich has compared, he was unable to discover more significance than the following: There is no course of temperature

which can be considered as denoting safety. The course is *probably* favorable when the temperature remains normal or a little above (not below) with a moderate remittent type, lasts but a fortnight, and then gradually subsides, without leaving behind any suspicious symptoms. Subnormal temperatures are especially common in peritonitis, and always suspicious; death may follow them closely. High and rising temperatures do not add, *per se*, arguments for an unfavorable termination, although adding another dangerous element to the case. It is not so much the actual height, as its constancy, which must be feared; as are also great and irregular fluctuations between very high and very low temperatures similar to pyæmia, common in endocarditis, less frequent in inflammations of the pericardium, pleura, and peritoneum; those are always highly dangerous. Hyperpyretic temperatures are especially met in peritonitis (puerperal form); they lead us to suspect an infectious origin, and indicate a speedy death with a high temperature. The forms of peritonitis in child-bed, which run their course without much elevation of temperature, are apparently to be grouped among local affections.

XI.—Acute Rheumatism.

The comparison of a few cases of rheumatism shows extreme discrepancies. Fever absent, moderate, intense, brief, protracted, continuous, remittent, etc. But the comparison of a great number of cases shows that these discrepancies may be reduced to certain groups and primary forms. And first, nearly half of the cases of acute rheumatism display a moderate amount of fever, which rises gradually, lingers a few days at its maximum, and descends with moderate remissions in two to three weeks; and though sensitive to external influences, is little affected by the occurrence of other inflammations. There is a discrepancy between the temperature and the pulse; no weekly cycles are observable.

The course is divisible into an ascending or *pyrogenic stage;* height of fever, a solitary *peak* or an *acme* of several days; and a *descending temperature*, which loses itself in *defervescence.* The *beginning* seldom comes under observation; we

know by report its rise to be more tedious than that of typhoid fever, though there are exceptions of 40° C.=106° F. reached in two to four days; but in good ordinary conditions the temperature is still very moderate at the end of the first week. Even the *height of the fever* escapes clinical observation. In the majority of hospital cases the *maximum* is reached the day of admission or directly after; the temperature beginning to decrease the same evening, rarely later. This course indicates either that the removal of rheumatic patients is injurious, or that good nursing soon alleviates the symptoms. Also, it appears that the earlier the reception into the hospital the quicker the fall of temperature.

However, the *maximum* often presents a solitary peak, is quite 40° C.=104° F., exceeding the previous temperature by 1°—2° C.=1.8°—3.6° F., or more, and occurs in the evening between the fifth and ninth day. The summit may extend into an actual fastigium, brief in comparison to the duration of the disease, shorter in proportion to the height of the temperature, the latter under 40° C.=104° F. The *fastigium* is longer than the succeeding period. Its course is either continuous, exacerbating, subremittent, or considerably remittent.

The course of the *descending* period depends on its form and suddenness. In favorable cases it is quick, and assumes the form of zigzag, a defervescent lysis of five to six days. A more rapid downfall, like a crisis, is exceptional. During the convalescence the temperature fluctuates on a plane of a few tenths higher than in healthy persons, so that the evening rise is almost febrile. Altogether the fever of acute rheumatism is only moderate and of medium severity.

But there are many *exceptions* to this medium and favorable course. *Abnormally mild cases* are particularly common. We cannot tell why the fever is so slight or absent, when the joint-affection is so severe, or even cardiac complications present. The other severe deviations do not amount altogether to one-sixth of the cases. Among them the commonest is the *protracted*. Numerous abnormalities protract it four or five weeks; the temperature may be normal in the morning, and even exceed 40° C.=104° F., in the evening. In a single day large fluctuations, as 3° C.=5.4° F. or more, show themselves when the affection of the joints becomes fixed.

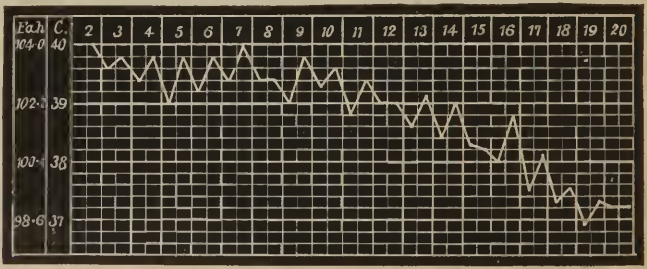
Recrudescence of fever, or apparently objectless intercur-

rent elevations of temperature of 2° C.=3.6° F., come right in the middle of a moderate course of fever, ephemeral or lasting, without evident connection. More slowly developing and protracted elevations may be associated with a relapse. The cases artificially depressed by digitalis, aconite, etc., and rising again when the medicine is left off or its therapeutic action exhausted, may be classed as apparent recrudescences.

Complications, especially pericarditis and endocarditis, have no effect on the course of the fever, or modify it as follows: In pericarditis and endocarditis, when they have produced valvular mischief, the temperature may remain unaffected during the fastigium, but becomes higher in the convalescence than usual, and it takes considerable time to come down to its norme. With fresh development of aortic valvular deficiency great elevations of temperature arise late in the disease; not so in mitral insufficiency. Other elevations are due to complications; pneumonia, for one.

Fig. 60.

POLYARTICULAR RHEUMATISM.



When articular rheumatism becomes fixed in a joint or bone, it may hang about a long while through recrudescence and complications, and displace itself with or without fresh disturbance of temperature. Such obstinate cases have occurred to Wunderlich more frequently in private than in hospital practice.

Among the fatal affections which accompany acute rheumatism, or have rheumatoid symptoms, one class is *fixed localization*. Death, in these cases, does not result from the rheumatism itself, but from the unfortunate course taken by some local manifestation or accessory to it. Another class included with acute rheumatism presents a malignant character revealed from the beginning or during the further progress of the affection. The

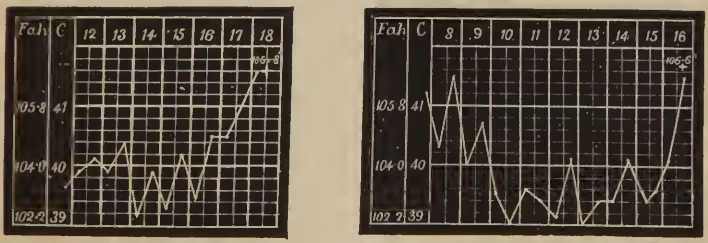
most common symptoms are rigor, intense fever, severe nervous symptoms, jaundice, hæmorrhage, diarrhœa, enlargement of the spleen. Death generally occurs with considerable, sometimes enormous, elevations of temperature, 43°—44° C.=109.4°—111.2° F., and more. These rheumatoid cases run in three different directions, the pyæmic, the icteric, and the nervous, corresponding to pyæmia, pernicious jaundice (acute yellow atrophy), and pernicious nervous catastrophes, devoid of anatomical basis. The nervous form is the less developed, the icteric the most pronounced, pyæmic the most complete. Rigor, jaundice, enlarged spleen are met with intense fever, moderated by deceptive remissions.

In the cases which end fatally, without multiple centres of suppuration or jaundice, the disease runs its course like a very severe articular rheumatism. A descending direction may even have set in, but suspicious nervous symptoms appear. With them the temperature reaches the most extreme degrees in the briefest time, so that death occurs with hyperpyretic temperatures; whilst no anatomical lesion of the brain can be discovered, only a very moderate degree of meningitis: *post-mortem* elevations of temperature may be met with.

Acute rheumatism is rather a disease of the adult. Infants and old people have it rarely, and less pyretic. Even in adults its degrees are seldom as high as those of typhoid fever or pneumonia; owing likely, infers Roger, to the facility and abundance of the perspiration. But when its temperature rises from 103°, 104°, to 107°, 108°, 109°, a fatal termination was expected

Figs. 61, 62.

FATAL RHEUMATISM.



within a few hours, when Wunderlich wrote his book. The cases reported by Quincke of 110.2°, and by Weber, of London, of 111.2°, did not recover.

Since, thermotherapeutics has conquered to human life a few degrees, as shown by the following cases of rheumatism, the first one being of *rhumatisme cerebrale*, so named in 1835 by my compatriot, Hervey de Chegoins.

1. From Wilson Fox (see Appendix XII., A, B). A female, B——, æt. 49. After two weeks of low temperatures in acute rheumatism of the lower joints the thermometer rose the fourteenth evening, at 9.55, to 109.1°. Put in the bath unconscious, cyanotic, pulse imperceptible, breathing by irregular gaspings; rectal temperature, 110°. Lumps of ice on the chest and abdomen; at 10.10 P.M. fall to 109.1°; at 10.15 to 108.4° (bath averaging 66° F.); at 10.20, 107.5°; at 10.25, 106.2°; pulse 140; consciousness returned. Brandy. At 10.35, 103.6°; 103° when taken out of the bath; at 10.55, 100.6°; at 11.5, 99.5°; at 11.25, 97.4°; unconscious; brandy, hot bottles, and bags. Midnight, T. 98.2°, P. 130, R. 43°; at 1 o'clock A.M., T. 99.4°, P. 118, R. 32. During that night the patient took, by the mouth or by enemata, twenty ounces of brandy, milk, eggs, beef-tea. Recovery (through fluctuations from 98°—102°) at the end of the third septenary.

2. From Da Costa (*American Journal of Medical Science*, January, 1875). Apyretic treatment of a woman, previously healthy, took cold, articular rheumatism.

Days	1.	2.	3.	4.	5.	6.		7.		8.	
						Mor.	Eve.	Mor.	Eve.	Mor.	Eve.
Temperature	..	105.5°	110°	103.5°	103.5°	100°	106°	105°	104°	103°	100°
Pulse	..	120	120	98	92	88	88	86	86	72	76
Respiration	..	40	25	32	36	40	40	40	40	40	36

Convalescent at the end of the septenary. Da Costa remarks that in his other cases (ten) of cerebral rheumatism, some died who had attained but comparatively low temperatures—one of them only 101°; that in the cases complicated by pericarditis and endocarditis the fluctuations of temperature were smaller than in the uncomplicated ones.

3. Drs. W. H. Draper and H. P. Maynard had in the Roosevelt Hospital a case which rose to 107½° F.=41.8° C., and cured; remarkable for the prompt subsidence of the pyrexia in the bath, its reaction when out of it, and the subsidence in it of

delirium and subsultus. Yet this case would not have likely been published but for its great similarity with Dr. Wilson Fox's (see Appendix XII., C.); for in New York the treatment of acute rheumatism by water is so well accepted, that extraordinary recoveries alone are recorded. In Paris silence comes from another motive. The *Société Médicale des Hôpitaux* had its attention called to three recoveries from acute or cerebral rheumatism at 40°, 41°, 42° C. by the apyretic treatment. The discussion went on, without reference to the much more remarkable cases of Wilson Fox and Da Costa, when Dr. D . . . . . objected to the communication as "dangerous, inasmuch as inexperienced physicians could take advantage of it to do mischief with this doubtful mode of treatment." (*Gaz. des Hôpitaux*, 16 Mars, 1875). Is that the France in which Trousseau and Roger endorsed Currie when Wunderlich was a boy?

XII.—Osteo-Myelitis.

In acute osteo-myelitis, which resembles typhoid fever in many respects, and has, therefore, been called *bone-typhus*, the course of temperature coincides accidentally with some typhoid attacks. Wunderlich reports six cases, of which five displayed a continuous course till the fatal termination. In three it lasted eight days, in one fourteen, the whole not a fortnight. One case died with a temperature of 40.7° C.=105.26° F., which rose after death to 41.1° C.=105.98° F. The fluctuations had been irregular, but trifling; the contrast striking between a comparatively moderate temperature and the enormous frequency of the pulse.

XIII.—Parenchymatous Inflammation of the Kidneys.

Acute inflammation of the kidneys (Bright's disease) has very little regularity of temperature. Its course seems dependent on the rapidity, intensity, and circumstances of the attack. Its temperature is rather moderate, sometimes 39.5°—40° C.=103.1°—104° F. In cases which recover the gradual defervescence is by lysis; in fatal cases death occurs in a rise or in a fall of temperature. Chronic inflammations of the kidneys affect the temperature very little, and even in fatal cases terminal elevations of temperature are exceptional.

XIV.—Hepatitis.

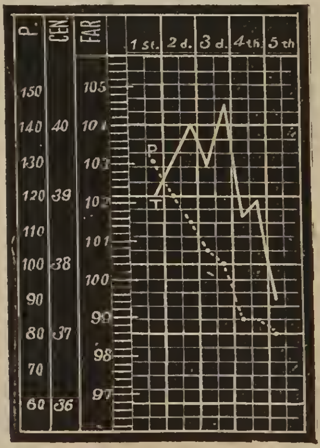
Acute parenchymatous inflammation of the liver exhibits varieties whose temperature differs widely; but no common principle can be deduced from the paucity of the observed cases. In the form with malignant pernicious jaundice, either from phosphorus poisoning or not, the temperature is sometimes unaffected, even unto death. In suppurative inflammation, with abscess of the liver, the temperature may follow the same course as in pyæmia and in chronic suppuration; repeated rigors, with great elevation of temperature, are observed in blennorrhœa of the gall-ducts and in abscess of the liver.

XV.—Yellow Fever.

In yellow fever, according to Schmidtlein's *Deutsches Archiv. für Klinische Medicin*, iv. 50, the temperature is highest in the first few days, 40°— 41° C. = 104°—105.8° F., with slight evening exacerbations; from the fourth to the fifth day the

Fig. 63.

YELLOW FEVER (TOUATRE).



temperature steadily falls down to normal, or even below; in fatal cases it rises again towards the end 2° C. = 3.6° F., or more. (*Wunderlich.*)

We are expected to know more about yellow fever in the United States.

Yellow fever has a short incubation of two to five days, rarely eight or more. It is important, from the start, to observe the pulse as well as the temperature, because their concordance at this stage is pathognomic, and serves to distinguish yellow fever from dengue, etc.

There is but one paroxysm, that of invasion. The temperature attains its acme the first, second or third day, with a fastigium ranging—according to the severity of the disease—from 38.9° to 43.4° C. It falls the third or fifth day, not quite to the norme, exceptionally lower; otherwise it rises again to 40° in fatal cases, accompanied with hæmorrhage, black-vomit, jaundice, and suppression of urines. Also, not unfrequent abscesses, malarial and other complications modify the late stage of this course.

When the initial temperature has reached 40.3°, there is imminent danger; at 43.4° treatment is useless.

Now for the pulse. It had begun quite in keeping with the *débuts* of the effervescence, but soon slacks behind the temperature and lingers in the 50, 40, 30, even 25 beats, accompanied with an easy and fated like countenance. That rhythm known as a *solemn pulse* bespeaks of some abdominal complication, and when the patient recovers, it continues to beat its solemn measure throughout the convalesence.

In other cases, the pulse rises from 72 in the morning to 120 in the afternoon, or from 112 (morn.) to 159 (even.); or descends from 108 (morn.) to 54 (afternoon), in discordance with the movement of the temperature, but in accordance with some sub-phenomena.

During the epidemic of yellow fever in British Guiana in 1852, Dr. Blair noticed strange irregularities in the temperature of the body-surfaces: sometimes the forehead was the hottest, at other times the cheek; uncovered parts would cool subito: but he could give no figures, having no surface-thermometer. With the fever-thermometer the axillary temperature reached 41.7° C.

In Appendix XIII., A and B, will be found a synopsis of the course of temperature and pulse in forty-eight cases of yellow fever, by Dr. Joseph Jones, of New Orleans, and another one of a single case, by Haenish, from *Ziemssen's Cyclopædia*. Dr. Jones' report is a very important document, from which we

condense the following figures: The synopsis shows twenty-three deaths against twenty-five convalescences.

Days of convalescence: the 1st, 2d, 11th, 12th, 13th, none; the 3d, 6th, 14th, one; the 4th, 8th, 9th, 10th, two; the 5th, five; the 7th, seven.

Days of death: the 1st, 2d, 12th, 13th, 15th, 16th, none; the 8th, 9th, 10th, 15th, 17th, one; the 3d, 4th, 11th, two; the 5th, three; the 6th, 7th, four.

From these figures we read the inferences:

(*a.*) That from the absence of convalescence or death during the first and second days, yellow fever is not as sudden a striker, as sometimes are cholera and scarlatina.

(*b.*) That the 11th, 12th, 13th days having no convalescence, and the 12th, 13th, 14th, 16th, no death, the second half of the second week is not critical.

(*c.*) That the 3d, 6th, and 14th (a multiple of 7), each with one convalescence, shows an earlier issue by lysis than the 8th, 9th, 10th, 15th, 17th days, without one death by catalysis.

(*d.*) That the 4th, 8th, 9th, 10th, with two convalescences, stand almost even with the 3d, 4th, 11th, which have two deaths.

(*e.*) That the chances of recovery or death the fifth day are even, 3—3.

(*f.*) That the seventh day with seven convalescences, and the 6th and 7th days with four deaths each, shows that in yellow fever one-third of the crises takes place in the limits of the Hippocratic septenary—a fact worth remembering, when the antique question of the critical days will be considered from the newest standpoint of mathematical thermometry.

Dr. Stone, of Woodville (La.), has noted a cadaveric smell as prodromic of yellow fever. Its confirmation could suggest some ingenious prophylaxis. Let it be ascertained.

CHAPTER XIX.

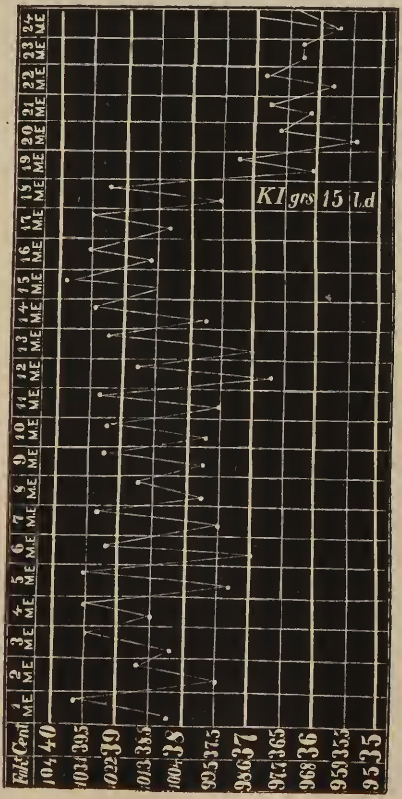
ANIMAL POISONS.

(Syn.: *Zoonoses* of Jaccoud.)

I.—Lues. (Syn.: *Constitutional Syphilis.*)

Syphilitic symptoms may develop themselves without fever, but with certain of them fever is far more common than is gen-

Fig. 64.



erally believed. This fever is so characteristic, that it is suspected by a single glance at the course of temperature as seen in Fig. 64.

In syphilitic cases elevated temperatures are most common at the time of the first extensive hyperæmic papular or pustular eruptions; the fever may be very severe with maxima at 41° C. = 105.8° F.; its course is markedly remittent, with a daily downfall quite to normal. The alternation of deep morning remissions and high evening exacerbations is tolerably regular; the duration of the fastigium is quite indefinite; the fever subsides by the exacerbations becoming less severe in the manner of the convalescence of typhoid fever.

In the acute syphilitic affections of the liver, brain, and bones, temperatures almost similar to the preceding are met. In the malignant form, so soon fatal, 40° C. = 104° F. are met, with or without remissions, which are deceptive; the fever has no regular course nor order. (See *Marasmus.*)

II.—Hydrophobia. (Syn.: *Rabies.*)

Inoculable from animal, or from man, to man; incubation lasting from a few hours to fourteen months, average forty days. Its admirable description by Bouley, well translated in English by Leotard, does not contain records of temperature. Brouardel, Landousy, Goffroy, Peter (of Paris), have observed great elevations of temperature in the last period. How much more valuable would be the thermography of the period of incubation, giving warnings equally precious to the infected one and to his circle of friends.

III.—Equinia. (Syn.: *Glanders and Farcy.*)

In the only case known by Wunderlich where temperature was taken (at first the fourteenth day of the disease), it was of moderate severity, rose from the nineteenth day in zigzag; and never sank, from the twenty-fifth day forward, below 40° C. = 104° F.; and in the last few days (fifth week) of the disease 41.3°—41.6°. C. = 106.34°—106.88° F. being obtained. No observation of the last twenty-four hours.

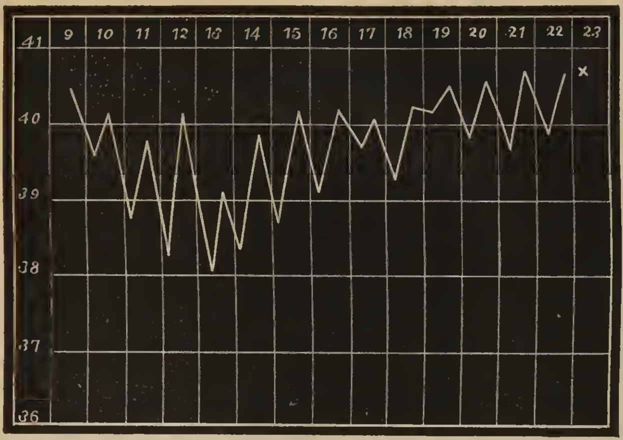
Mr. de Morgan reports, in the *British Medical Journal*,

April, 1870, a case whose temperature was not very high, but rose at death, the twentieth day, to 40.2° C. = 104.4° F. Jaccoud is more explicit.

Fig. 65.

EQUINIA.

Diagram of acute glanders, by Summerbrodt.



Equinia is transmitted from animal to man by contact of the skin bare of its epidermis, or by close cohabitation; the inoculation is rapid, one to four days; the infection slow, three or four weeks; men catch it more readily than women (Saussier's experiments), besides being more exposed. By inoculation, the pus of glanders may produce farcy, and *vice versâ*. The prodromic temperatures (and other symptoms), not unlike those of trichinosis, are those of purulent infection interspersed with chills, rigors, etc. In the stage of eruption and invasion, the temperature rises to 40°—41° with morning and evening ecarts of one to two degrees; no outbreaks, but a steady march by broad undulations (see diagram) towards the fated issue; all the way the pulse at 110—130, and the respiration, laborious at 40—44 remain, harmonious with the temperature. A specific odor emanates from the body, death comes in coma about the third week, though some are cut down in three days, and few linger more than fifty.

IV.—Trichinosis.

Trichina spiralis, found on the dead, are mere objects of reference or curiosity, and cannot be searched on the living without a strong presumption of their presence. The symptoms—fever, diarrhœa, muscular pains, etc.—are so unspecific, and even variable, that we must look for other signs. Thermometry affords some already, though more are wanted to establish the law. (What we give is from the old New York Hospital Reports.)

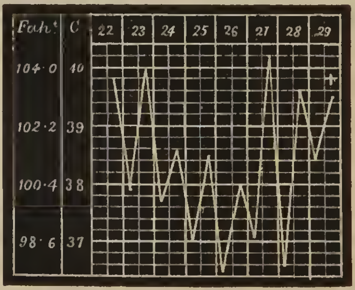
Trichinosis was first diagnosed and microscopically demonstrated on the living, by Dr. E. C. Seguin in 1867 (Case No. 13), just before the introduction of the clinical thermometer in that institution.

Soon after came a case hardly suspected before the post-mortem proof of its nature was given, in 1868 (Case No. 217.)

The third case was early recognized by living tissue being, as in Case No. I., brought under the microscope, and it recovered:

Fig. 66.—From the N. Y. Hosp. Reports, Vol. 48.

TRICHINOSIS.



This diagram gives the first clue to a trichinic temperature evolution. A fever much like the continuous, with well-marked and rather even morning remissions near the norme, and evening exacerbations even to 40°, 41°. This period, lasting one, two or more weeks, walled up by a perturbatio critica of about forty-eight hours in the fatal case, during which is broken the previous concordance of ustion circulation and res-

piration. Then from this perturbatio issues, either a chaotic rise similar to the one which ends the typhus, or a sloping resolution in which concur the three great vital functions.

Meanwhile, quinine may have supported the strength, but not affected the pyretic diurnal évolution, as it would have done in an idiopathic fever.

CHAPTER XX.

PULMONARY CONSUMPTION.

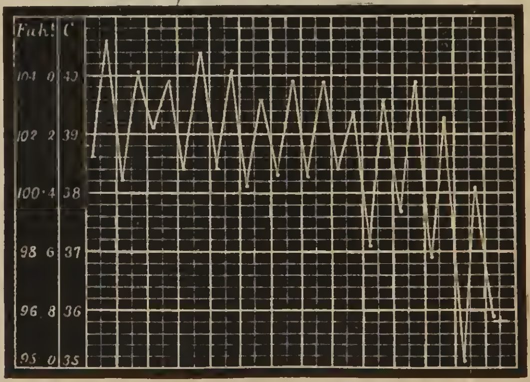
Recent researches tend to reconstitute the former unity of pulmonary consumption, and thermometry will help considerably this work of reconstruction.

I.—Acute Miliary Tuberculosis, etc.

Acute miliary tuberculosis produces alterations of temperature generally proportionate to the abundance of the tubercular deposits. When the miliary tubercles are scanty and localized, or the patient is under the influence of previous diathesis, as advanced phthisis, cerebral disease, etc., his temperature is slightly affected, if at all, by the tuberculosis.

Fig. 67.

MILIARY TUBERCULOSIS.



The course of temperature in miliary tuberculosis shapes itself like that of an incipient catarrh ending in hectic fever; of typhoid fever, or of intermittent fever; and these forms may succeed each other in a single case. The first is met in sub-

acute cases. As regards temperature, it commences like in severe influenza; only the persistence of the fever excites suspicion. Gradually deep remissions, almost to a normal temperature, alternate with high evening exacerbations, rendering acute tuberculosis undistinguishable from non-tuberculous phthisis, even up to death; unless meningeal tubercles are developed, and the characteristic symptoms of basilar meningitis are manifest. In the second form, the temperature is more irregular and the remissions greater than in typhoid fever, from which the diagnosis is often impossible to the time of death. These cases are most rapidly fatal; should they escape, the fever assumes the hectic or the intermittent type, rarely the latter. In it, the course of the temperature of each fever-abscess (or local suppuration) may perfectly resemble that of an intermittent fever, even to a tertian or duplicated quotidian rhythm; yet, the afternoon attack, the lower height of temperature, and the deeper apyrexia (below normal), point to acute tuberculosis. In the further course the intermittent type is succeeded by a milder remittent which clears up any remaining uncertainty.

II.—Acute Phthisis.

Acute phthisis may originate in a condition perfectly free from fever, upon which elevations of temperature supervene in zigzag with remissions and exacerbations of increasing severity. It may closely follow the fever of bronchitis, pneumonia, etc., a protracted intermittent, confinement in dark and damp places, exhaustion or defective nutrition, etc.

In the progress of the disease the course of the temperature is non-continuous, except in phthisis galopante. The daily differences are as high or higher than 3° C.=5.4° F.; the daily maxima (sometimes two) approximate to, or exceed 40°—41° C. =104°—105.8° F. The daily falls are abrupt, their maxima descending to the normal point, or below. Even profound collapse is not rare. An alternation from day to day is sometimes displayed in the remissions, more so in the exacerbations. Intercurrently the remissions become less and the course becomes subcontinuous in an ascending type: complications, like pneumonia, may bring other modifications.

The fever is often interrupted, also, by short (less often by

longer) intervals of moderate fever, or of subfebrile, or even of normal temperature. It is rare to meet with a persistent subcontinuous course with considerable or moderate fever from the very beginning to the fatal end; but it is a common occurrence at the approach of death, for the temperature falls from its previous height, and the remissions become less distinct; unless (rarely) the temperature, which had previously fallen, rises afresh during the death-agony, even to hyperpyretic heights.

Sydney Ringer, *On the Temperature of the Body as a Means of Diagnosis in Phthisis and Tuberculosis* (1865), asserts that there is an elevation of temperature in all cases of tubercular deposit; Wunderlich says that there are intervals free from fever in some cases of phthisis; and that in some cases miliary tuberculosis does not affect the temperature at all. Henri Roger says, "Si dans l'enfance, comme aux périodes plus avancées de la vie, les tubercules donnent quelquefois lieu à un accroissement de chaleur animale, ce n'est point par eux-mêmes, mais par leurs effets consecutifs, par l'irritation locale que leur présence détermine dans les tissus. Lorsque cette inflammation n'existe pas, ou est devenue chronique, le thermomètre monte à peine au dessus du niveau ordinaire. Andral a constaté pareillement chez les adultes que la temperature reste normale dans la phthisie pulmonaire tant que la fièvre ne s'allume point" (*De la Temperature chez les Enfants*, Paris, 1844). Hérard and V. Cornil assert that, without complications, there is no fever in the stage of deposit (*De la Phthisie Pulmonaire*, 1867)

These discrepancies among high authorities are more apparent than real. Roger's cases (p. 368, etc.) contradict his theory by showing rises of temperatures followed by apyretic tendencies towards the terminus. Andral's words, "the temperature remains normal as long as fever does not set in," are not worth commenting. The "there is no fever *in* the stage of deposit," leaves off the other stages. For Charcot, acute tuberculization is frequent, but latent in the aged. Phthisis is slow and insidious in the viellards; and again, "in the absence of local symptoms, the thermometer alone can detect pulmonary consumption in old people." (*Leçons sur les maladies des viellards*, Chap. II.)

Finlayson adopts the three types of Sir W. Jenner; the *insidious*, the *active febrile*, and the *adynamic* phthisis.

First type.—Morning temperatures normal, or under; even-

ing's more or less high. Ex.:—A child has a temperature of 99.32° F. in the morning, and in the evening 101.53°—101.80° (in rectum). This equals the "insidious," and often "unexpectedly fatal type."

Second type.—The morning and evening temperatures are both high, whilst there are evening exacerbations. Ex.:—A child has a morning temperature of 100.16° F., and an evening's of 101.57°—103.67° F., the "active febrile type."

Third type.—The morning and evening temperatures are both high, but there is a tendency to exacerbations at odd times. Ex.:—On one day the child has a morning temperature of 102° F., and in the evening of 102.33° F. On another day the morning and evening temperature may be respectively 102.6° and 104° F.; this characterizes the "adynamic type."

Practically all the cases can be grouped about the two following types:

(*a*). *Acute pulmonary consumption,* which runs its course in a few septenaries. In it the three vital signs are parallel. Temperature 38°—40.5°. Most of the time small morning and evening *écarts* between 39°—40°, ending at 37.5° C. Pulse 118 to 180 beats, average 140. Respirations 36 to 60, average 50. Fever continuous.

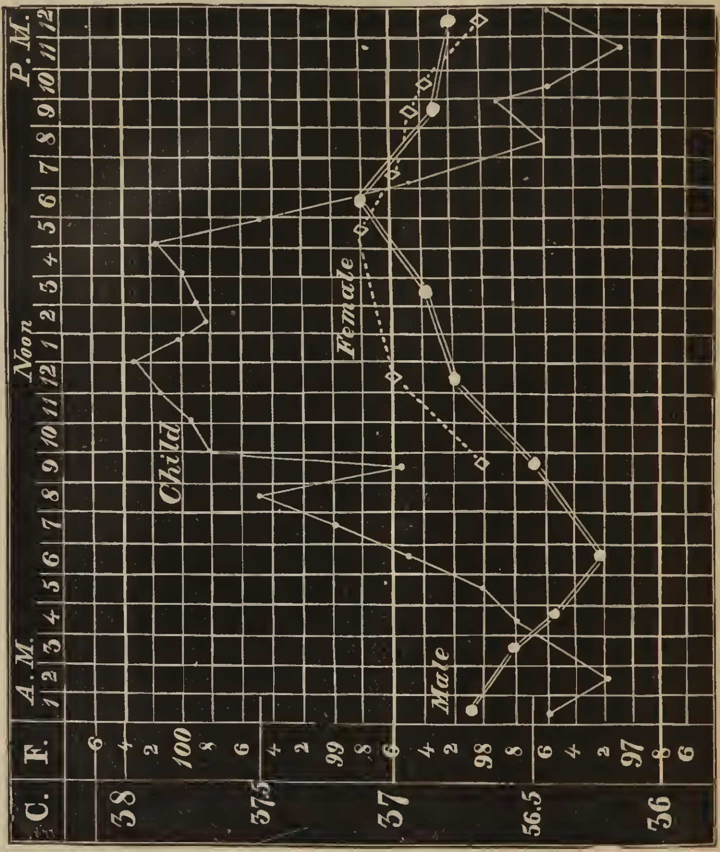
(*b*). *Slow pulmonary consumption.* After the latent initial period, of which Sidney Ringer has conquered the diagnosis by thermometry, this affection proceeds, like its congener, the *acute meningitis of the convexity,* by *poussées* not yet very well observed. During the remissions, the temperature comes back to the norme or a little below; during the exacerbations, the magnitude of the *écarts* is in proportion to the magnitude of the pathological injury to the tissues. But towards the end the remissions become less distinct, till the fever becomes almost continuous at a point, 39.5°—40.5°, dependent on the intensity and duration of the previous ustion, nutrition, etc.

On the whole, the march of *pulmonary consumption* is ascending—with or without remissions—till the last septenary, when it falls, barring rare exceptions; the breathing growing shorter and quicker, and the pulse rising in inverse ratio to the temperature, till it reaches unaccountable strokes,—triple effect of asphyxia and inanition.

It is rather the *course* than the *height* of the temperature which must be consulted in phthisis. To study that effect is sub-

joined the Fig. 68, from Dr. Woodman, which combines Finlayson's table of the oscillations of temperature during twenty-four

Fig. 68.



hours in healthy children with Dr. Ogle's tables of temperatures in male and female adults.

From another point of view phthisis appears in two extreme forms:

a.—The slow and silent consumption (once considered non-tubercular), whose temperature may descend below the norme, even to 34° (Weber), for three isolated or concurrent causes, the failing of the thermogenic apparatus, the impairment of the

digestive and assimilative functions, and the exhaustion from diarrhœa.

b.—The phthisis called galopante, whose final hyperpyrexia continues after death.

But in ordinary cases the temperature is above the norme, as Sydney Ringer found it in its prodromes. It is not always equally so: its lowering will be found to correspond to certain periods in the evolution of the tuberculosis; higher during tuberculization, lower during or after large expectorations and vomits, lower still after hæmophthisis.

Another pyretic sign is the progressive increase of the *écàrt* of the evening from the morning temperature (2°—3° C.); but when the end is near, the *écart* diminishes by the rise of the morning ustion to the height of the evening's. Slow consumption not uncommonly ends in apyrexia.

CHAPTER XXI.

MALARIOUS DISEASES.

I. Intermittent Fever. (Syn.: *Ague*, *Chills and Fever*, *Paludal Fever*.)

Intermittent fever is, more than any other disease, characterized by rapid temperature changes from hot to cold, and by temperature inequalities from the centre to the periphery; the latter exceeded only in cholera.

Another peculiarity of the intermittent fever is the many forms it assumes: some affecting only its periodicity (that is, among the intermittent proper); others taking a bilious, a pulmonary, a cephalic or any other localized nervous types; others again enveloping themselves in such disguises as to deserve the appellation of masked or larved, or endowed with such mobility or swiftness that they cannot be called otherwise than erratic: all, however, recognizable at one sign—the periodicity of its extreme temperatures.

Senac is probably the first who remarked that in the shivering cold stage of the intermittent, a thermometer introduced into the mouth did not mark any fall of temperature. (De Recondita febrium. Intermitt. Natura.) Gavaret mathematically demonstrated in 1839 the increase of body-heat when the febricant shivers with cold, and its precedence of some hours before the chill, by which signs the therapeutist is warned in time to administer the antidote. Baerensprung and Michael have found the same elevation of central temperature before and during the *fieber-frost*, but several years after Gavaret, and figure it as: .5°—1° C., one or two hours before the chill, rapidly increasing during it by several degrees; and when perspiration begins, falling by a kind of defervescence called *en terrace.*

Thermometrically, we distinguish in intermittent fevers the

course of an isolated *paroxysm*, and the series of these paroxysms which constitute a whole *morbid entity*.

The separate *paroxysms* are each characterized by a sudden rise of temperature (generally with rigors and cold shivers) to a height of extreme fever and an equally rapid return to the normal, or below it. The rise is the first symptom. It may continue slow for a few hours, up to 38.5°—39° C.=101.3°—102.2° F. With the rigor it starts up in one hour to 41°—41.5° C.=105.8°—106.7° F. Meanwhile, the stage of dry heat (hot stage) may have set in, and the rise go on to the acme of the paroxysm, forming a summit-pointed or slightly bifid.

The *maximum* is reached in the stage of dry heat, or when partial sweating appears; it only lasts a few minutes. With the sweating (moist stage), the temperature descends slowly for the first hour or so, then fluctuates, then falls decidedly without any fresh rise. However steady may be this fall, it is accomplished by an alternation of horizontal progressions and partial descents, some at the rate of one-tenth, some at that of one-half of a degree per hour, whose downward lines form terraces, which in four hours bring the temperature back to 40° C.=104° F. Then it sinks somewhat more rapidly, requiring, however, ten or twelve hours more to regain the normal point, 37° C.=98.6° F.

During the *apyrexia* the temperature may fall below normal; but if it lasts more than a day, there is a slight evening exacerbation. Not infrequently the use of quinine suppresses the subjective symptoms, but leaves the elevation of temperature almost equal to that of a complete paroxysm. Then rise and fall are compressed into less time than when there is rigor. This behavior of the temperature in the paroxysm is so characteristic of intermittent fever (ague, etc.), that it renders its diagnosis tolerably certain. There are very few diseases in which it rises so rapidly from the norme to 41°—41.5°=105.8°—106.7° F., and returns there with equal fleetness. The study of the temperatures of a single paroxysm is therefore sufficient to differentiate intermittent from typhus, meningitis and cholera, at least.

The paroxysms of intermittent fever succeed one another and have several rhythms, whence their *nosologic entity*.

The simplest of all is the *quotidian*, whose paroxysms return every twenty-four hours.

In the variety called *double quotidian* there is two daily paroxysms.

Fig. 69.

QUOTIDIAN FEVER.

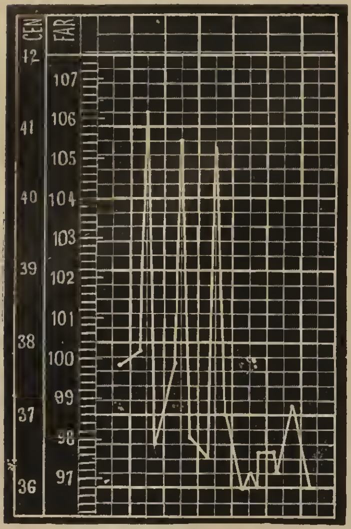
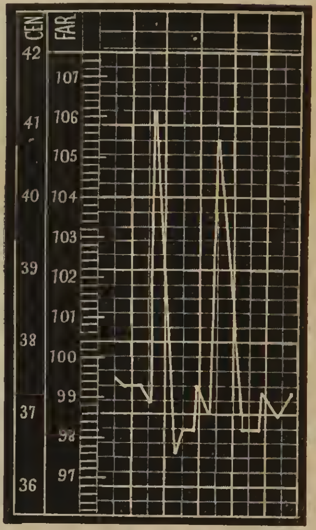


Fig. 70.

TERTIAN FEVER.



The *tertian*, whose paroxysm returns the third day, therefore every other day.

The *quartan*, whose paroxysm returns every fourth day—that is, after two days of apyrexy.

Thermometry alone is often able to reveal the fact that the apparently simple quotidian, tertian and quartan are duplicated; that is, have a stronger paroxysm followed by a weaker one.

Among the *larved*, let us mention the *algid intermittent*, which runs its course without pyrexia. Like all of them, its masks cannot cover its periodicity, and falls under the action of true antiperiodics.

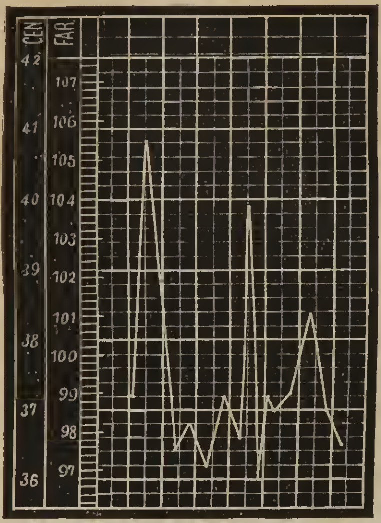
The *bilious remittent*, whose paroxysms are less distinct, the fever more continuous.

It begins by a moderate initial chill followed by a hot stage, after which the algidity begins; temperature in the mouth 86°—88°, in the axilla 84° F.; the body becoming cold like marble. In the meanwhile there is a subjective feeling of burning and thirst; the flabby skin is pale or livid, covered

with cold sweat; the pupil dilated, the look vacant, the lips without expression; the tongue soft, smooth and pale; the

Fig. 71.

QUARTAN FEVER.



region of the stomach sensitive (Hertz in Ziemssen's *Cyclopædia*). Torti more expressively said (1712): *Tertia perniciosa hominem jugulat—symptoma ferox.* In its worse forms it is essentially a produce of the Tropics, transferred by ships from Aspinwall, Mobile, etc., to our Northern hospitals. Its records on board are blank, and it is only after the first septenary that the symptoms are tabulated, when death permits.

II.—Malignant Malarial.

A high temperature develops the malignancy. The accidents are without relation to the kind of disease, epidemic constitution, idiosyncrasy (Trousseau). Why we cannot furnish diagrams of malignant intermittent, any more than of congestive remittent, by climatic exaggeration, is, according to the vivid expression of Tissot, because *a disease is malignant when it strikes as the dog who bites without barking.* When the

second or third access is prevented, *it was not the pernicious;* if not prevented it kills, leaving in either alternative no time for thermometric observations. It flourishes on the banks of low rivers like the Maumee River, or on the affluents of the Yonne, near Clamecy, France, where hemp is deposited to rot and bleach; as well as on the affluents of the lakes of Central Africa, where Gordon (of the Stanley expedition) recently died in a cold stage of one hour. Less rapidly murderous was the combination of malarial with typhic elements, which, under the name of Chickahominy fever, mowed the besieging army before Richmond in our civil war twelve years ago. It is unfortunate that no thermometric records were then kept by the medical staff of the United States.

But there is a tendency to view the fevers more connectedly. After much acuteness spent in distinguishing these fevers, we treat them as if they were but one with several degrees: a practice likely more sound than the theory.

Complete recovery from all malarial fevers can only be testified by thermometry. We know that intermittent may be broken by quinine, etc.; but is not cured, and will reappear with a provoking cause, or without—some say in periods corresponding to the Hippocratic septenaries. For my own part, the cases whose recovery assumed the permanency of a law, were those in which the use of quinine was continued every seventh day, starting from the last of the fever, for a length of time commensurate to its previous duration. Old cases have to be quininized every spring and fall, or sent to parts several thousand feet above the place where they got zymotized. Indeed, there is no disease—cholera and sun-stroke possibly excepted—in which thermometry can render such services as in intermittent. Yet it has not given in it all its natural results, because we have followed only one set of observations—the course of the central temperatures; when the other one—the course of the peripheric temperatures—ought to have been as thoroughly recorded. Where surface-temperatures were taken it was with a fever thermometer, in or on the hand, under the foot or between the toes, on some point of the convexity of the forehead, or in a fold of relaxed skin; fanciful operations, capable of discrediting thermometry at large.

The thermal history of intermittent fever and of most of the local phlegmasiæ will become possible only when good, sen-

sitive surface-thermometers will be applied to the periphery, and correct fever-thermometers to some accepted cavity. From these comparative operations will be announced, and may be prevented, or at least attenuated, these fearful inequalities of surface and central temperatures, hyperustions here, and frigerations there, between which life is like a wrecking vessel in a dancing sea.

In intermittent we had already two fine specimens of apyrexy—the incidental and the localized frigeration.

But let us survey this field from a higher ground:

After all, the philosophy of fevers is adequate to their thermography. Their phlegmasy is more or less violent according to climate; their prodromic chill is sensible or not; their pyrexy may reach farther and remain longer above the norme, or the reverse; the progressions may be ascending, descending or alternate; the paroxysm may be matutinal or vesperal, diurnal or postponed several days; it is nevertheless the same enemy under different masks. A dam is formed to create a water-power in a valley; it will cause hundreds to be struck with the autumnal and spring fever, and to be engraved on thousands the features of malarial cachexy. The pond of Lindre (Dept. of the Meurthe, France) was fifty years ago managed in rotation: the first year, filled with water, it grew fish in, and intermittent out; the second year the crop was fished from the low water, and the typhoid fever was rife at the margin; the third year the surface was allowed to dry and remain fallow, then carbuncles were as thick as blackberries; and every third year the same crops were grown as by the hand of idiots. But latterly, the pond being kept full, for industrial purposes, intermittents ruled in all their modalities, from the ephemeral to the malignant, with such authority that they generally baffled the efforts of fourteen physicians and four druggists; the criminal who did this got rich.

The paludeal element is more poisonous as it advances south, as digitalis grown in the fissures of rock at a southern exposure is many times stronger than that of our gardens, as the sprouts of conium, eaten like asparagus in Sweden, would kill in France or in this Republic.

Those who deny the miasmatic nature of fever may try to go out early and breathe it before the action of the sun has raised the heavy layer of moisture which keeps the lethal prin-

ciple on a level with the organs of inhalation. Those who believe in it must surround their properties and residences with thick curtains of American cedar, or Australian eucalyptus, and ornament their yards, or even their modest windows, with hops, hemp, or sunflowers, not likely the only vegetables which enjoy swallowing the effluvia deadening for us, fattening for them.

CHAPTER XXII.

APYRETIC DISEASES.

A coldness below nature, *Frigor prœter naturam*, is at the foundation of all apyretic diseases, or conditions.

To better understand how our body becomes apyretic, let us repeat that human temperature has several factors: the *production* of heat by the modification of the blood and tissues, and by respiratory oxidations. The *loss* of heat by contact, rayonnement, evaporation, expiration, labor. The *equilibration* of its production, exhalation and repartition on the divers parts of the body by the circulatory apparels, whose movements are under the immediate order of the nervous system.

Hyperpyretic temperatures have been studied conformably to this theory of human *calor*, caloricity, and been traced to their factors: an excess of production, too great a deperdition, an inequal repartition, and a failure of the moderating functions.

Now devolves upon us the converse task of tracing, whenever we find traces of them, the connections of the apyretic forms of distemper with the factors of low temperature, *Frigor prœter naturam*, in the human body, viz.: diminished production, increased deperdition, irregular distribution of heat, or a stunning of the great sympathetic, which stops its harmonizing action.

A survey of the cold field of the body-temperature shows that besides being either *central*, *peripheric* or *local*, *apyrexy* may be congenial, or brought on by frigorigenic causes; may be the expression of a single or of compound circumstances; may stand alone or between pyrexiæ, may be in ascending or in descending progression; may be a misstep of the defervescence, or a status (*état d'être*), which may or will henceforth constitute a healthy abnormal norme.

In other words, regarding its duration, it may be ephemeral, periodic, continuous, ascending, descending, modifiable, or irre-

trievable. It causes, in order of intensity, cooling, frigidity, algidity and congelation.

From this survey it appears: first, that though apyretic diseases are nominally few, apyretic conditions are many and frequent; and second, that not a few of the latter have already attracted our attention, as either antithetic to, or intercalated with some of the pyretic conditions before studied: carried by the current-force of their common subject. Thus have we observed apyretic temperatures as the lower terms of extreme fluctuations, or as the mathematical rendering of the exhaustion of combustible materials after exaggerated ustions. Then, when treating of surgical temperatures, we had to confront the high and the low, in order to render their respective or common causation more striking, and the theory and practice of their treatment more forcible. Since, in the fevers of malarious origin, we have just met with true, though intermittent apyrexiæ; and lastly, when soon treating of the temperatures of nervous affections, we will meet with extreme ones both ways of the scale; and we do not intend to sacrifice the advantages of closely comparing them to the systematic pleasure of separating them in yet imperfect categories.

Roger did this, and tried to force all diseases in the pigeonholes of pyrexy and apyrexy; but as many refused to enter, he set them apart under the head of *stationary.* That will do as an indication towards the future, and to mark the *terra incognita* of our present thermography; but we had better keep yet for a while close by Nature, which has thrown the most extreme temperatures in the same, or in apparently similar morbid conditions (in lesions of the spine, for instance), in order likely to let us compare, and find out the why? . . . However, where the law of apyrexy is distinctly traceable, as in certain diseases of the aged, and in certain conditions of the new-born, we will be most happy to follow Charcot and Roger in their appreciation of senile and infantile apyrexiæ.

I.—Temperature in Cholera.

Cholera incubation lasts from a few hours to four days, and the premonitory diarrhœa a few days only (Vienna Conference, 1874).

The temperature presents the same signs in sporadic as in epidemic cholera, only less marked.

First in this field, as in several others, Magendie announced in his *Lessons* of 1832, at the College de France, the fall of temperature in cholera, and called the students' attention to the discrepancy between the surface and central temperatures. This early observation ought to have been soon followed by new discoveries. But several difficulties retarded the study of the temperature in cholera. One, that though cholera is a morbid entity, it is also a trilogy, whose phases are not only distinct, but different. A choleric may die in the stage of *active cooling*, in that of *passive algidity*, and in the *pyretic reaction*, which can even continue its ascendancy after death. Till the temperatures of these phases is studied distinctly and comparatively, we may be able to say with Magendie in the most general terms, and barring exceptions, that cholera is an apyretic disease; but in observing individual cases our judgment will stumble against unexpected and unexplainable pyrexiæ in the middle of a ruling algidity.

This difficulty is aggravated by another. In cholera, the points of selection most favorable to ordinary thermometric observations become obliterated, and partly or temporarily useless or even deceitful. The parched axilla emits hardly any radiated heat, and is not much hotter than any other point of the open surface (though anointing with A A glycerine and water may restore part of its heat-radiating property). The mouth is moist, but clammy cold, notoriously below the central temperature; the rectum and vagina remain the most trusty representatives of the central temperature. unless the thermometer becomes embedded in fæces one way, and in diphtheritic exudations the other.

It is Lorain who first insisted upon taking the temperature of cholerics *in recto*. He gave (1850) among the results of his observations on seventy-four cases: minima, one at 34°, two at 35°, ten at 36° (rectal). In forty-seven cases the index remained at the norme, in twenty-seven it rose to 38°, in fifteen to 39°, and once at 40° C.

However, the axillary temperature becomes valuable *per se* in the period of pyretic reaction, and by comparison with the vaginal and rectal. A great difference between these three temperatures is unfavorable; but a rise in the temperature of

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the mouth, with a fall in that of the vagina or rectum, promises well.

In sporadic as in epidemic cholera, the difference between the central and peripheric temperature is often extreme, as 36°, 37° in the rectum; 33°, 34° in the mouth; and 21°—24° on the hand. Yet the central algidity is neither constant nor considerable in cholera as in the sclerema, where children are not unlike to cold-blooded animals. The algidity increases from cholera infantum to the sporadic and epidemic. The prognosis is grave, with a fall of 4°—5° in the mouth, and from 2°—3° in the axilla, but mortal with the same in the rectum. Czermak did not witness a single cure where the temperature of the feet had been 24°. Wunderlich, too, noticed the diagnostic value of the low temperature of the feet and hands; but how can it be mathematically measured without surface-thermometers, thermoscopes, etc.? It is difficult to conceive of the successive performance of these delicate operations with the fever-thermometer, so ill adapted to surfaces, so tedious in its indications. But the difficulty increases when the question is to take these temperatures during the successive phases of cholera which have almost nothing in common but their contiguity, as we will presently see.

In the cholerine form, after the first painless watery stools and vomit, the temperature becomes lower: though the causes of this lowering are not all from the evacuations; since it has been noted to precede them in patients under observation for other diseases before any other symptom appears, and thus to be prodromic of the advent of cholera.

In the *stage of evacuations* of slight cases, which do not become asphyxiated, the axillary, vaginal and rectal temperatures remain in their normal relations, or the vaginal a little raised. With indications of asphyxia, these temperatures begin to diverge—vaginal higher, and axillary somewhat lower than normal. When flaky substances (albuminoid) pass, cramps come, and algidity sets in. In the algide form *that will recover*, the temperature of internal parts is moderate, rarely exceeding 39.6° C.=103.28° F., and seldom normal or below.

In the *algide stage* there is little purging, alterations of the fibrin of the blood, arrest of secretions and of aëration of the blood, mortal coldness, coma. Later yet the blood becomes glacial, and communicates an icy coldness. The body is so be-

numbed by cold that it is rendered insensible to the contact with boiling water. Choleraic algidity is felt colder by the physician than it is shown by the thermometer. on account of the accompanying cold sweat. The central fall is ordinarily 4°—5°, rarely 9°—10° F. The extremities are coldest, then the face, the mouth, the tongue, the periphery of the body at large; the axilla (which is no test for the central, nor for the peripheric temperatures), the rectal highest of all. Such vivid descriptions abound; but no figures given in support of the relations of the various peripheric temperatures to the central, nor of their modifications by a *pyrogenic medication*. (See second part.)

Adult choleraics have rarely revived from 14° below the norme (Czermak says 13°); but no children from 4—5° Ph. = 32.5° C. = 90° F.

In *death by asphyxia* the vaginal and rectal temperatures reach higher, 40°, even 42.4° C. =104°—108.32° F. Profuse and violent alvine discharges are indicated by a fall. When the temperature rises (even only relatively to the other symptoms), it announces the cessation of the alvine discharges. A rapid and considerable fall and a rapid and considerable rise of temperature are warnings of death; on the contrary, the less the temperature fluctuates the more probability of recovery. During the algide stage, the temperature of the skin falls indeed very low, 35° C.=95° F. The axillary fluctuates less than the internal. Rapid changes of surface temperature are threatening. A low temperature slowly and steadily rising, with only slight fluctuations which hardly exceed the normal, is of good omen. Lowest of all may be the temperature under the tongue; in asphyxia it seldom exceeds 31° C. = 87.8° F.; even cases at 26° C. = 78.8° F. have recovered; none below.

In the *post-choleraic*, or reaction period, the temperature returns from its abnormal condition to its norme again, yet moderately febrile elevations are not dangerous, but must awake the attention; higher elevations of temperature are sure signs of complications and local affections, which narrow the prospect of recovery. Very high temperatures are induced by parotitis, erysipelas, and more rarely by atypical pneumonia. Roseola and other exanthems do not always induce a rise of temperature. A normal or quasi-normal temperature in the post-choleraic stage is no guaranty of recovery; but 42° is considered mortal.

In a *typhoidal reaction* the temperature may be normal or a little higher, or rise above, and take a remittent course; these are stormy cases; if they do not end by death at once, they are much protracted. Parenchymatous nephritis is one of the sequels in both forms of reaction.

The most unfavorable omen in the post-choleraic period is when a normal or elevated temperature suddenly sinks below normal. A considerable loss of surface-warmth indicates great danger.

Magendie, Briquet, Mignot have often noted a rapid ascension of temperature as death sets in.

In many cases the temperature of the body begins to fall just after death; in others (especially with those previously high), it rises for some minutes or half an hour after death.

CHAPTER XXIII.

TEMPERATURE IN DISEASES OF THE NERVOUS SYSTEM.

This is a subject more vast than our knowledge of it.

Nervous diseases are just now the theme of the most ardent studies. Since the pioneers, Magendie, Bayle, Le Gallois, Flourens, Brown-Séqnard, Cl. Bernard, Virchow, Shiff, have posed the generalities, the young school, Charcot, Vulpian, Bourneville, Lépine, Hitzig, Fritsch, E. Dupuy, Ferriere, H. Jackson, B. Sanderson, etc., are throwing the bases of localization and of temperature in nervous affections. Need I say that the work is hardly begun, and that I can report it only as far as I am informed.

I.—Temperature in Affections of the Brain.

Charcot and Bourneville, above all, have carefully investigated the temperature in *cerebral hæmorrhage* and *softening*, and have reached valuable conclusions. (See Appendix XV.)

a.—Cerebral hæmorrhage has a definite course of temperature, whose very modifications indicate the gravity of the disease. In cases of average severity, from the stroke to seven hours later the temperature falls even to 35.8° ; then follows a second period, in which the temperature reascends to the norme or a trifle beyond it, and remains about that figure for several days, when if recovery is to take place, the absolute norme is reached : this is the stationary period.

In similar common cases which are to terminate fatally, there occurs, after one, two, or four days, a raise of temperature which goes on increasing until death, when the mercury may have reached 40°, 41°, even 42°.

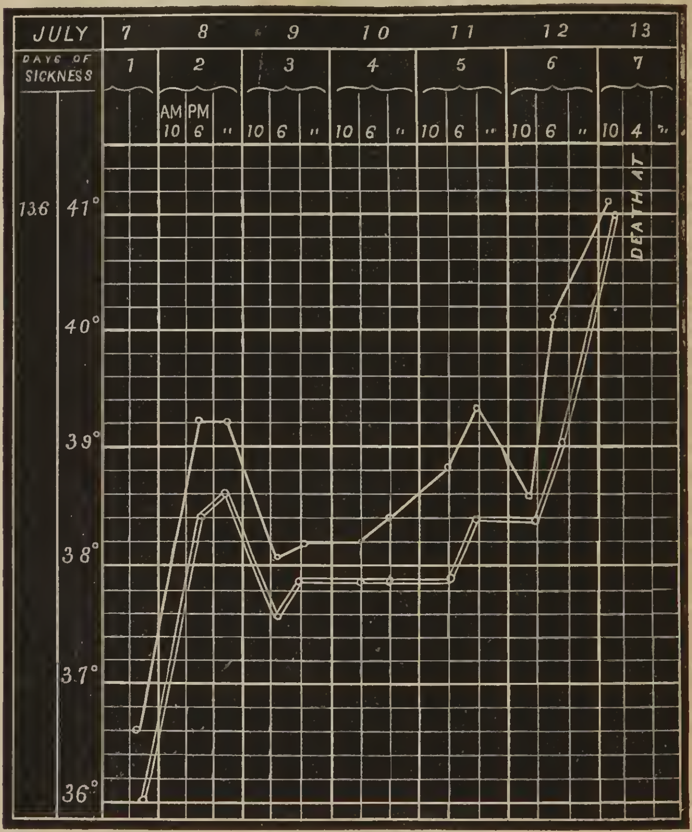
In extremely severe cases, *apoplexie foudroyante*, or multi-

ple hæmorrhages succeeding each other in rapid succession, there is no other thermic condition but the initial fall, uninterrupted from the moment of the seizure till death.

In cases of great severity short of that just referred to, the initial depression is present, but instead of a succeeding stationary period, we have a rise of temperature continuing until death.

FIG. 72.

CEREBRAL HÆMORRHAGE (from Lépine).



In other words, in cases in which a fatal issue is certain in a few hours or days, the stationary period is wanting, the initial depression is followed by abnormally great heat; in cases which will prove very quickly fatal, there is only a rise of tem-

perature; in cases in which recovery is to take place, we have initial depression, stationary period, and return to the norme; in cases in which, after initial depression and stationary period, there occurs a rise of temperature, death is quite certain.

During the periods of stationary and rising temperature, that is, the first few hours or days, a new depression below the norme indicates a fresh effusion of blood. The pulse and respiration vary so much in all these thermometric periods, that they are wholly unreliable guides to prognosis. A few minutes after death, the rectal temperature may reach a point a few tenths of a degree above that noted just before the fatal issue; and the fall of temperature afterward is slow, the mercury standing in some cases at 40° for as long as an hour, in one instance the loss of heat amounted to only .7° in three hours; in another, to .4° in one hour.

b.—The course of temperatnre in *softening of the brain* presents the following contrast with *cerebral hæmorrhage:*

In cases of *acute cerebral softening*, it is very seldom that any initial depression is observed. When present, it is of much smaller amount than in cases of hæmorrhage—for example, 37°, 37.2°, 37.8°—while the mercury goes below the norme in cerebral hæmorrhage.

When the softening involves a whole lobe or a large part of a lobe, and is to terminate fatally in from one to three days, the temperature rises until death. In cases of extreme severity with softening of the corpus striatum, as well as of the convolutions, the thermometric course almost exactly resembles that observed in cerebral hæmorrhage.

In cases of softening involving smaller brain lesions, and terminating fatally in from five to fifteen days, Bourneville discovered remarkable, and as he thinks diagnostic oscillations of temperature: variations of from 1°—2° in each day, until near the end, when a further rise reaches 39°—40.8°—42° at death. (In some cases the rectal temperature was quite normal at some hour of the day.)

In cases of softening which get well, a gradual rise takes place from the period of attack to the third or fourth day, the mercury reaching 39.4°—39.8°, and then a fall to the normal occurs, complete by the fourth or sixth day. At the close of this period the central heat would be a little below the norme for a day or two.

To resume, except in extraordinary cases, the *initial* lowering of temperature is missing, or less characterized in *softening* than in *hæmorrhage;* temperature remaining at 37°—37.8° in the two hours following the attack. The *stationary* period, which follows, is marked in *softening* by a standstill, or by irregular morning or evening remissions; whilst in *cerebral hæmorrhage* the temperature remains above 39°, and falls to the norme only from the effects of new effusions of blood. The *ascending* period of *softening* follows the stationary later and slower than the corresponding one in *hæmorrhage.* The *therminal* temperatures of *softening* (barring the first exception) are lower than those of *cerebral hæmorrhage.*

c.—Temperature in Insanity.—For obvious reasons there is no typical temperature *in insanity.* For less acceptable reasons the subject has not been elucidated as it deserves.

Temperature is higher in the insane than in the sane. It is highest in phthisical mania, very high too in general paralysis, particularly when it runs a short course, and towards the end; and is gradually falling in the following order: in acute mania, epileptic insanity, melancholia, mania, mild dementia, and complete dementia—the latter being the only form in which the average temperature falls below the human norme,—yet the evening temperature of every form of insanity (even of complete dementia) is higher than the evening norme. (See Appendix XVI.)

The difference between the morning and evening temperatures is due, at first, to the evening rise. The proportion of this evening rise may serve to foretell the ratio of mortality. In general this death-rate has its acme in general paralysis. When phthisical insanity is acute the temperature runs high, when latent it almost evades thermometric investigation.

The lowest temperatures found in chronic insanity by Loewenhardt, were: in one case 25°—31.4°, and in another, 23.7°—21°, during the last five days. They were not melancholic, but violent, throwing off their clothing by a low external temperature; had ideas of *grandeur* without general paralysis.

The greatest individual differences of temperature in the same form of insanity were met with in general paralysis, in epileptic insanity, and in acute mania; as much as 8.7° C. in the former.

The temperatures taken by Langdon (see Appendix XVI.)

confirm in the main those of Clouston, accepted by Maudsley (see Bibliography). They show that everything being equal in each species of insanity, the temperature falls and the pulse relents in proportion to the length of the affection. The young resident physician of the Hudson River Asylum pointed out to me the general fact that in recent paresis the pulse and temperature are low; and the special fact that, if it is complicated of delusions and excitement—irrespective of the gravity of the paretic symptoms—the circulation and ustion are much higher. Accordingly, I counted in his first case of recent paresis with illusions, agitation, etc., the average temperature 99.125° F., and the average pulse 89.2; and in his second quiet case, average T. 98.15°, and average P. 67; making for the first an elevation of almost 1°F., and of 22 beats to the minute.

Thus excitement increases 1°—2° the temperature of the insane; so eventually (not always) does inanition, exposure, general paralysis, in which case the hyperpyrexy follows a preagonic ascension. In the great majority the progression of ustion is a descending one. As the insane grows older the colder he becomes, particularly in the morning—a warning that he has spent more caloric than he could generate, and will soon die.

d.—TEMPERATURE IN IDIOCY.—For obvious reasons too the same remark obtains for *idiots;* the great majority of whom die early without hardly giving a warning of their illness—apparently from one disease or another, oftener from latent pneumonia, but really from exhaustion of caloric and paralysis of caloricity.

In 1860, I took the temperature of almost all the idiots of the New York State Asylum, at Syracuse, N. Y.; but the instrument to be procured then and there was imperfect, and I substitute for my figures those obtained recently by my friend Dr. Van Duyn, surgeon of this institution (see Appendix XVII.) with a Casella's thermometer—as good as a Fahrenheit can be.

From the thirty-three cases observed by Van Duyn it appears that the mean temperature of the idiot is found in the morning, the maximum at mid-day, the minimum in the evening; the pulse and breathing showing the same fluctuations, but not always in the same cases. There are exceptions, however, of which a close examination of each subject could only give the key; but operating on figures, instead of on subjects, the frequency of these thermic indications is remarkable, considering,

moreover, that a State asylum, as the one managed by my friend, H. B. Wilbur, is opened to a great variety of helpless children, under the generic appellation of idiots.

What is the meaning of these figures on the training of idiots? We can as well answer this question here, since we will likely find no opportunity to recur to it. These figures signify that the exercises of attention, comparison, minute imitation, must principally (not exclusively) occupy the morning session; the training of activity, group imitation and articulation the middle session; and the evening to be given to games, plays, sweet songs before going to bed; in virtue of the axiom: where there is no disposable *calor* do not ask *labor*.

We cannot form a judgment so precise in regard to the cretins. We have only six observations (see appendix XVII., e); besides, the subjects of three soon died, leaving in doubt if the record of their vital signs represented strictly the status of cretinism, or its combination with the signs of the incipient disease. All three died of pneumonia, accompanied by general infiltration of the mucous (and serous?) membranes, whose signs are negative breathing, pulse, and temperature (not apyretic) with a gradual (no remittent) sinking of all the synergies. I called this long ago the *cretin's pneumonia* (it is their common fate), it resembles in young subjects the kind Charcot since discovered at the Salpêtrière, and named *la pneumonie des Vieillards*. (See Chap. XVIII., § III.) Dr. Wilbur knows more than me now about it.

But to read these figures, as well as to take new and more valuable ones, it is necessary to not search in *insanity* and *idiocy* for what is not more in them, and to remember that the conditions so called are never primary, sometimes even not secondary, but tertiary ones. Thus insanity was creeping in, felt or not, fought against or concealed, in the forms of hyperexiæ, wakefulness, palpitations, headache, etc., for years, even during several generations, before it burst unruly; and idiocy has been a drama in utero, or at the breast, long before the alterations of organs and functions were synthesied in leaky temperatures ill-supplied by an imperfect calorification.

II.—Temperature in Affections of the Spine.

In diseases and lesions of the spinal cord no systematic observations of temperature have been carried to conclusions. If we could assimilate the results of diseases of the medulla in man to those obtained by Cl. Bernard, Tschechichin, Pochoy and a few others, after systematic sections or crushings of the medulla in animals, we would say that injuries of the medulla below the dorsal enlargement cause only temporary falls of temperature, followed by rises, whose march and possible heights are yet undetermined; and that the same lesions produced above that point are followed by a steady and progressive cooling, till death ensues. (See Appendix XVIII.) But on man himself we have only isolated or accidental observations of temperature in affections of the chorda, and we will give them *ad referendum*, without pretence to completeness or systematization.

a.—The medulla spinalis is considered the organ whence originates *infantile paralysis.* (Charcot, Geoffroy, Cornil, E. C. Seguin.) In its acute form this paralysis is rarely seen in adults. Temperature and pulse high, fever continuous at 39°, 40°, or more; movements difficult, soon impossible on the affected side, then crippleness and atrophy That is the acute form. Or the paralysis creeps on insidiously; fatigue, aching, etc., too often disregarded; then progressive denutrition of the affected parts, called *déjrus* by the French peasantry. Heine observed in his cases of infantile paralysis a difference of .5°—1.5°, between the healthy and palsied limbs. Brown-Séquard has shown, and daily experience proves, that the contrary obtains in the prodromic and incipient stages of paralysis; and that the hyperpyrexy of the soon-to-be paralyzed side or part is pathognomonic. The rule is a higher temperature at the beginning, and a lower one in the chronic stage of paralysis.

Though Roger and Brechet differ considerably in their conclusions, this is the better elucidated part of the subject.

The first experiments of Chossat (1820), and the first observation of Sir Benjamin Brodie (1835), opened the way to the study of the temperature in cases of *injury to the spinal* cord. This latter was a case of crushing of the lowest part of the cervical medulla, showing 43.9° twenty-four hours after the acci-

dent. Billroth since found 42.2°, fifty hours after a fracture of the spine; Quincke, 43.4°, and 43.6° C. = 110.12°, and 110.48° F., in two cases; Weber (of London), 44° C. = 112.2° F. in two cases; Simon, 44° the third day after a fracture of the twelfth dorsal vertebra; Frerichs 43.8° nineteen hours after the fracture of the fifth and sixth cervical vertebræ; Fisher met with 42.9° once, against two cases of fall of temperature to 34° C. = 93.2° F. in recto, and 30.2° C. = 86.36° F. in the axilla. More recently Farquharson reported before the Clinical Society of London a case of dislocation of the first dorsal vertebra, and injury of the cord with temperature at 82° F.; and Hutchinson had a case of injury to the cervical spine, with paraplegia, which survived five days, with a temperature never above 94.5° F. (But Churchill had the same lesion with 110° at death; see *Lancet*, 29th May, 1875.) Brown-Séquard found a rise in all the cases he collected, and maintains, however, that if in lieu of being hurt, the spine is only irritated, the temperature must fall instead of rise.

These discrepancies show that the question is yet unsettled; we want more facts, and there is one which will extend but not solve the difficulty: the most extraordinary rise of temperature occurred in a case communicated in February last to the London Medical Society, by Dr. Teale, of Scarborough: Sept. 4, 1874, a lady thrown from her horse had the fifth and sixth rib fractured, and some obscure injury to the spine. Soon the bones united, the spine only remaining tender.

As there was no paralysis of sensation or motion, the cord itself was not supposed to be primarily affected; only a pressure on it of the inflamed spinal ligaments and intervertebral substances: nothing like a definite diagnosis.

At the end of the first month the temperature was 101° F.; at the end of the second (October) 105°; with respiration unaltered, pulse 100, 105°; the sixth day of November a rise to 110°; the eight day, 118°; the thirteenth, according to the *Lancet*, 122°; the fourteenth, according to the *Medical Times and Gazette*, 125°. This figure, being the highest the thermometer could register, was reached five times more from date to December 1st, alternating with fluctuations to 114°.

During the first half of this last-named month 110° was reached, and during the second half 114°.

For seven weeks the temperature never fell below 108°, rarely below 110.°

Early in January (fifth month), it fell to 104°, and about the tenth to 98.6°.

Pulse never above 120; respiration quite feeble, but never much embarrassed; catameniæ suppressed, urine scanty, liquid food taken (sometimes *per ani*). The fourth month the spinal sensibility began to diminish, and the general health to improve; cured the sixth.

(The observations taken in the axilla, between the thighs, and in the rectum, differed from each other only a few tenths of a degree. Seven instruments were used at various times, four of which were afterward verified at Kew and found accurate. They had been inspected by two or three competent witnesses before and after each application, and the results instantly registered.)

Even reducing the maximum temperature (125°) given by the *Medical Times*, to that of the *Lancet* (122°), this case and cure changes entirely a written page of the natural history of man. We must be on the watch for more cases.

III.—Temperature in Affections of the Peripheric Nerves.

Few of these affections are anatomically demonstrable; yet their peripheric nature cannot be denied where thermometry asserts their localization. A girl, æt. twenty, being very hot after a violent exercise, put one of her hands to cool on a marble tablet. Instant semi-insensibility and semi-paralysis ensued, with a notable—but not mathematically measured—difference of temperature between the two hands. No improvement for ten years, and likely none since.

In two cases of otitis with intense pains, I have seen falls of temperature lasting several weeks, and marking $\overline{.5}^\circ$—$\overline{1.6}^\circ$ (below the norme). But was the apyrexy caused by the neuralgia proper, or by the pain consequent to it?

Another form of peripheric nervous affection is the peripheric or spinal epilepsy, contradistinguished from cerebral epilepsy by Brown-Séquard. But we have not been able to procure the thermography of a single case, and will defer what

we have to say on the temperature of epilepsy till the next paragraph.

IV.—Temperature in Central Neuroses.

From the experiments of Claude Bernard, Brown-Séquard, Shiff, etc., we are prepared to see the most excessive rise or fall of temperature follow sections, crushes, injuries of, or compressions and impressions on the centres of sympathy, and of regulation of the great vital functions. And precisely because much remains to be learned, we know that the tendency of the physiologists and pathologists is to restore to the great sympathetic many of the ruling attributes which have been heaped like a crown on the brain. But this idea will be clearer twenty years hence.

a.—The *shock* (Syn.: *ictus*) is a collapse of the central nervous power, caused by accidental, surgical, or spontaneous lesions (whose vastness bears no relation to the severity of the shock); by a moral impression, by arrest of the heart's action, and by simple concussion (without lesion) at the epigastrium, maxillary angle, scrotum, etc. It is the more imminent since the wounds, contusions, and concussions are nearer the abdominal plexus. It has been observed in the most varied circumstances—shell-wounds, ovariotomy, opening of a whitlow, strangulated hernia (vide below, § *d*), as well as in the operations for its reduction. Brown-Séquard produced shock by simple compression of an intestinal fold. Its invariable effect is to lower the temperature, and eventually to paralyze the pyrogenic functions through the stunning of the great sympathetic. In 1858, Cl. Bernard had already demonstrated the lowering of the temperature by the section of the pneumogastric. From this date, every experiment in that direction shows the shock to be a nervous affection, and confirms the position assigned in human thermogenesis to the great sympathetic.

b.—*Insolation* (Syn.: *Sunstroke*, *Heat Apoplexy*, *Maladie Astrale, etc.*).—This stroke, popularly attributed to the light of the sun, is more frequent in a heated and moist atmosphere, compressed under low clouds; that is why the French call it either *coup de chaleur* or *coup de soleil.* It was called *maladie*

astrale, because of suspected sidereal dispositions, some making it frequent, some rare.

If excessive *insolation* kills outright, *asolation* decomposes slower, but sure. Its effects have been particularly verified in localities which, once agricole, are now absorbed by manufacturing interests. There, where 60 years ago more little children died from want of clothing and comfort, to-day more adults die, particularly men of twenty to thirty; and one-third of the whole population is affected with tuberculosis. Why? Shut up from the action of the sun all day, they have a minimum of red corpuscles, and no provision of combustible to satisfy the eventual exigencies of combustion of a fever; so that their diseases are all of a low type, they have no reaction, and when they die of a pyrexia it looks as if it was from apyrexy.

If the heat-stroke can be prevented in man, who is unconscious of its imminence, it is by his own or his friends' knowledge of its prodromes. As studied by Vallin on dogs, buccal and pulmonary secretions were abundant and frothy. Respiration from 40, 50 at first, reaching 160. Temperature (its norme is according to kind, 37.4°—39.6°) reaches 43.5°. Later the respiration relents even to 60, but suspirious; intelligence and sensibility preserved; temperature, 43.5°—44°. Lastly convulsions, coma, death at 44.4° C. Immediately no galvanic response of the muscles or nerves; prompt rigidity and putridity; blood black in the arteries as in the veins; almost no trace of oxygen in the former (Cl. Bernard).

Watson curiously and justly enough compares the effects of heat-struck to those of cold-struck, and cerebral congestion by cold to apoplexy by heat. Same appearance in the cadaver, same anatomical lesions, paralysis of the centres of innervation, rapid decomposition (only retarded by the action of the external cold continuing after death); and more, same moral causes inducing the stroke, as described in Larrey's *Memoires of the Retreat of Moscow*, 1812. Discouragement, fatigue, privation, and above all the pressure of tight garments impervious to the cutaneous evaporation, add to the casualties.

In this time of centennial reminiscence we must be excused if we bring one to the point. At the battle of Monmouth, June 28, 1778, without receiving a wound, fifty-nine Hessian soldiers fell from the effects of the extraordinary heat and of their heavy clothing; and many more fell on the side of the

Americans. (Surgeon Shoepff's report, in Boston Med. and Surg. Journal, June, 1875.)

In pre-thermometric times, Andral had signalized the prompt putrefaction of the bodies stricken by the sun. Now, thermometry teaches that in this *apoplexy* the heat attains to degrees where the decomposition of the blood is sufficient to cause death. Have been observed, 41.66°, 42.88°, 43°, 43.4°, 43.77°, even 45° C.; by Baulmer, 42.9° C. = 109.22° F.; by Dowler, 45° C. = 113° F., etc.

Wunderlich had seen no cure when 42.125° had been passed. Lewig cured a case which had attained 42.8°. It was reserved to American physicians to go beyond that by the use of the mathematical apyretic medication.

From the Bellevue Hospital Reports, 1872–3:—

(1.) Dr. Atzenbach's case: Entered comatose; temperature, 110½° F. = 43.35° C. = 6.35° above the norme, which fell to 104¾° in two hours, under the application of the wet sheet kept cool by sprinkling; during which the pulse and respiration rose first, then fell (figures not given). Chest cupped during half an hour on account of cyanosis; pack renewed during another half hour; temperature 102°; total fall in 3.30 hours, 8½° F. = 4.65° C.; cold sponging again, digitalis, more fall, recovery.

(2.) Dr. Perry's case: Comatose, puffing respiration, tracheal rales; temperature, 106¼°; stripped, laid on india-rubber cover; body alternately rubbed with ice, or with a sponge wetted with ice-water; then water poured from a pitcher from a height of three or more feet, adding the impression of the shock to that of the cold. In fifteen minutes fall of temperature to 101¾°; of pulse from 160° to 120°; cure.

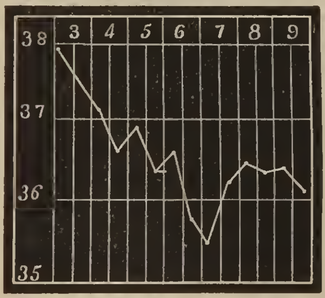
Fanning increases the evaporating and cooling powers of water. Hot water too hastens the cutaneous evaporation, and so diminishes central hyperpyrexia. By such treatment as these, a fall of 5°—6° F. = 2.5°—3.5° C., may be obtained in one hour and a half, in cases of sunstroke, whose acme is rarely above 105°—106°, and the proportion of recovery greatly increased.

c.—Summer-complaint. A softening of the nervous system by a super-heated atmosphere weakening all the functions, and expressed mainly by diarrhœa, torpor, head-cries, and occasional fits, ending in convulsions, oftener in coma. Curable under the trees, along a cool stream.

Its temperature is tempered by its symptoms. Its high fever-degrees are repeatedly put down by the apyretic effect of evacuations. tenesm, and deperdition of forces. The proportions of the latter regulate the downward course of the pyrexy, which soon becomes an apyrexy. Through that double movement we have two guides—the increased frequency of the pulse, and the diminishing body weight. Therein is the mathematics of the death of those who are born only to be called angels.

We know that more than half the mortality of the city of New York strikes children under five years, and that in the last weeks of July, just ending, we have lost 815 and 955 children: that is attributed to improper nourishment; but why would not the food kill as many all the year round? Because the principal factor in these murders is the brick-oven habitation provided for the working classes, by M. Phalaris, Esq., and landlord. But if guinea-pigs were exposed to the same murderous temperature for the sake of demonstrating its fatal effects on children, the wife of said Esq. and landlord would faint away. Such cruelty to animals!

Fig. 73.
INTESTINAL OCCLUSION.



d.—Intestinal occlusion. An apyretic affection of a descending continuous type. Its symptoms are progressively pains, constipation, meteorism, vomiting of alimentary, sero-bilious or fecaloid matters; the aggravation is continuous, or composed of successive occlusions, and reopening of the bowels, leading both to death, unless relief is afforded. The scheme of its apyrexy runs as follows: beginning in the lowest physiological temperatures $\overline{.4}$ $\overline{.6}$ $\overline{.8}$, and descending to $\overline{1}$, $\overline{1.5}$, $\overline{2}$, $\overline{3}$, without reaction, but those produced by hot enemas, etc. Concurrently the

facies becomes altered, the tegnments cyanosed, the pulse feeble, the perspiration viscous, the voice soundless, the respiration short, leading to asphyxia. Electricity often re-establishes the function, apparently as a pyretic treatment. Is it by the shock which starts anew the peristaltic action, by the conversion of electricity in caloric, by the generation of heat during passive movement, or by a larger afflux of blood, singly or concurrently?

e.—Tetanos. In tetanos the temperature increases progressively, if not continuously, till death, which happens at 41°, 42°, even 44.75° (Wunderlich). This ascension takes place, not by morning or evening exacerbations, but in concordance with irregular convulsive access, in which the disengagement of heat, by muscular contraction, must not be overlooked; rest, if obtainable by anæsthesia, would be a cure for that almost incurable affection.

V.—Temperature in Convulsive Affections.

When the nature of convulsions is left obscure by the other symptoms, it is indicated by their temperature, which suffices to assign, at least, their generic character. Thus, when the muscular contractions are accompanied by an elevation of temperature, the convulsion is tonic, as in tetanus and epilepsy; but when the muscular contraction is entirely spent (converted) in movement, the blood not being overheated, the temperature remains about the norme, or falls below, as it happens in chorea, where there is a free liberation of heat by muscular contraction; and in paralysis agitans, where 37.2°, 37.6° have been found with two hundred double oscillations per minute. These, and the following differences in the temperature of convulsive affections, have been established mainly by Charcot and Bouchard, and admirably expressed by Bourneville.

Temperature is the better criterion of *epilepsy* at large, and of its modalities. But of what use, since men already entrusted with Universities teach that St. John cures the *haut-mal*, and St. Gilles the *petit-mal*.

(*a.*) During and between isolated accesses, it is subject to fluctuations. T. S. Clouston first spoke of a fall of temperature preceding the fit; Charcot, Gibson, A. Voisin, Bourneville, have noted a rise during, and a fall between the accesses

(which those who simulate epilepsy cannot well imitate without being betrayed by the unnaturalness of their muscular exertions).

(*b.*) During the *status epilepticus*, the temperature progressively increases from the first fit; does not fall so low as after a single one, and attains in a few hours, 40°—41°.

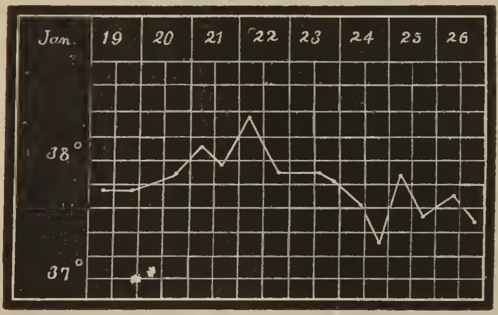
(*c.*) The epileptic fits of general paralysis are always followed by a greatly increased temperature, which lasts for several days.

(*d.*) The epileptiform fits of hysteria develop an extraordinary low (sub-febrile) temperature, compared to other forms: as *per* example: During three months of violent and almost incessant convulsions, in which the status epilepticus rose to the highest degree of intensity, the degrees of caloric evolved attained but once 38.5° and habitually oscillated between 37.4° and 37.8°.

(*e.*) But when higher temperatures supervene and death ensues, it is the effect of asphyxia. (See Wunderlich, in Arch. der Heilkunde, 1864.)

Fig. 74.

HYSTERO-EPILEPSY.



Let us sum up the preceding remarks:

In cerebral hæmorrhage, the temperature falls at first; in true apoplexy it rises from the stroke (Charcot, Westphal).

In epilepsy the thermometer often attains 40°; in an hystero-epileptic attack, rarely 38° C.

In puerperal eclampsy it attains 40°; in convulsive uremia it falls, sometimes, to 28° C.

d.—The temperature of *Eclampsy* will be considered altogether with those of *uremia*.

e.—Extasy.

Extase is a nervous disease of the most humiliating epochs, just now spreading again. It is difficult to discriminate in the extatic what is the legitimate produce of hypnotism, compression and imposition on a feeble subject, from his share of complicity in the imposture. For the complicity does not negative the neurosis, and the epi-phenomena of both become intricate. Thermometry could have thrown some light on extasy, but the managers of extatics do not want light. Wunderlich proposed to take the observation of the last case, but was not permitted. Here it is.

Louise Lateau, of Bois d'Haine, Belgique, enters daily in extasis, and is marked with the stigmata of crucifixion. Since four years she has taken no food, no drink, no sleep, no rest; yet, by expiration, she exhales carbonic acid and water, which do not come from her own substance, since she loses no weight. Besides, her monthly periods are regular, and every Friday blood ooses out from her stigmata, during cataleptic seizures and rigidity, *in honor of the crucifixion of Jesus, à qui ça doit faire bien plaisir*. However, this spectacle may be prevented, or stopped, by Mgr. the Bishop of Tournay, in virtue of his power of *Rappel* over extases, etc.

The temperature of Louise Lateau was taken but once, and found 37.3° C. The Academy of Medicine of Bruxelle made a mild report, from which it appears that Belgian physicians walk the sacred grounds of Bois d'Haine as if they had in their boots the scorpions which tread at their heels.

As for the end of the extatic? One of them, La Sallette, after having been the means of raising millions, became unprofitable, and was thrown in the cesspool of the Salpêtrière; and on her being singled out, was transferred to some more silent *vade in pace:* away with the girl, up with the miracles she heralded. Nevertheless, extasy is a nervous disease, which can be made scarce by educating our children out of the pale of the mystics.

§ VI.—Temperature in Disorders of the Blood and Secretions.

We can hardly say that we leave the map of the nervous affections when searching the temperatures in *disorders of the blood;* for these disorders were first traced to lesions of the mesocephale and fourth ventricle (Cl. Bernard), since to other regions of the encephalon and of the medulla (Shiff), later to simple commotion of the nervous centres (Jaccond), to moral impressions on the sympathetic (Brown-Séquard, Cl. Bernard, etc.).

a.—Glycosuria (Syn.: *Diabetis*), of whatever origin, when confirmed and uncomplicated, is always below the norme, from 1° to 5° F.; though in the early stage of glycogenesis, with increased appetite, the temperature may have remained about normal, only once in a while depressed (Vogel). The evening figures are generally higher by .1°—.8° F. than the morning ones; the reverse obtains in the closing period.

Though the lowering of the body-heat is due to the loss of sugar, thermal measurement does not show it every day proportionate to this daily loss; the downward movement of the ustion is more uniform, the glycorrhea more variable. The lowering of the temperature in diabetes is attributed to the incapacity of the liver to chemically work the main fuel of the body; so that sugar is expelled without having been converted by oxidation, and human *calor* is diminished by that much.

b.—Polyuria. There is a relation, but not a constant one, between the temperature and the quantity of urine, the former falling as the latter increases; the latter being somewhat influenced by the quantity, sometimes excessive, of the water drunk, at other times by the nervous condition (*urines critiques*). However, through all these irregularities, the quantity of water passed does not exceed the quantity ingurgitated (Vogel). Warm drinks depress less the temperature than cold ones.

c.—Albuminury, like polyury and glycosury, tending toward consumption, soon assumes the courses of temperature characteristic of that termination.

d.—Uremia, of whatever origin, has a low temperature, which

after a fluctuating or downward course ends with the life, as low, sometimes, as 28°—33° C. True poisoning by an excess of carbonate of ammonia (Billroth).

This is true of uremia in encephalopathy of the neo-nati, in scarlatina and in Bright's disease, but not as a complication in puerperal eclampsy. The upward tendencies of the latter counteract the downward one of uremia, the result being a compound temperature in which the strongest element—generally the eclamptic—predominates.

For instance, in a case of forceps delivery, ending the following day in death, the phenomena of eclampsy priming those of uremia, the temperature starts at 39.4° with the first attack; is to-morrow early, 41.8°, at 9 A.M., dying, 42.9°, rising soon to 43°, 43.1° *post-mortem*. But when uremia is intermittent, the temperature too is intermittent, only in an inverse ratio, and passing several times from the neighborhood of 37° to lower degrees, till 33° is reached as a finale. And again, when uremia is decreasing, the pathological temperature, mainly controlled by eclampsy, rises, and ceases with it, going up with the first attack to 39°—40.2°, and coming down to 37.8°—37.5°, convalescent point of these combined affections. These thermometric data are surer tests of prognostication than the pulse, the respiration, or the indications of the urine, which, though albuminous, may contain no albumen when just tested.

Chronic uremia may descend to 34.4° (Hirsh); Sidney Ringer has seen it 92° F. before death.

Infantile uremia was observed by Parrot to cause a fall in one day from 37.2° to 35.6°; in seven days, from 37.2° to 34.5°; from 32.4° to 29.6°; and the tetaniform convulsions of neonati (one to sixteen days old), to reduce at once their caloricity to 34.2°, 33.4°, 32.1°.

Temperature is the test by excellence of this class of affections. In purely uremic convulsions there is a progressive fall of temperature. In cerebral hemorrhage the initial fall is soon followed by a rise. Uremic eclampsy begins by a fall; puerperal eclampsy commences by a rise, which goes increasing, etc.

In some neuroses of the hysterical order, polyury is accompanied by a great diminution of urea and fall of temperature; conversely the excretion of urea may become abundant at the time urine becomes scanty and the temperature rises. In eclamp-

sy, tetanus, strychnisme, the temperature rises and urea diminishes.

In phlegmasiæ, the diminution of the temperature and of urea with an increased liberation of chlorures, is the best sign of convalescence; of which see illustrations in Appendix XII., *a*, *b*.

e.—The *cancerous cachexy* does not of itself affect much the temperature. This is demonstrated by the cases (Roger, Da Costa) on which the parts affected have no office in the acts of nutrition; for instance, in the cancers of the face, the mammæ, the uterus, etc., where even a slight rise may be noted a few days before death. But when the cancer is situated in the organs whose office is connected with nutrition and calorification, from the mouth to the lower bowels, the temperature falls in proportion to the denutrition.

Therefore, the modalities of ustion alone are no test of the cancer, but in comparison with those of the circulation they are. Thus, next to ustion usually oscillating between 37° and 38.4°, and rarely closing as low as 35.8°, let us bring pulse-beats of 130—160, and see the meaning of this discrepancy, viz.: the cancer, almost foreign to ustion, is pre-eminently a disease of the blood.

f.—*Scorbut*, when it affects previously healthy people, does not lower, rather raises the temperatures. But in already debilitated people, as those who had suffered the long privations of the siege of Paris, in 1870, this may descend to about 36°.

g.—*Gangrene* is a local obliteration of the circulation brought on successively by syncope of the parts (almost invariably the parts the more exposed to radiation), local asphyxia, stasis of venous blood, exclusion of oxygenated blood, peripheric extension of the obliteration. This march is the ratio of its temperature. In its application, a gangrenous foot has a temperature lower than a healthy one, as 22°—33°, 34° C., in the same atmosphere. In the gangrene of the lungs of the insane, the temperature is sub-normal; of other people it is above the norme, sometimes 40°. Topographically, the centre of a gangrenous sore is the coldest part; its periphery is somewhat warmer, and the surrounding angry circle (in which the blood-vessels begin to imbibe the cachexia) is decidedly above the norme. (See Appendix XIX., for gangrene of the mouth of infants.)

Senile Temperatures.

If senility is no disease, it invites many, and withstands not a few. In old age, ills creep insidiously, and their symptoms are not expressed with the frank exaggeration of youth, nor the precision of virility. This led Charcot to the creation and nomination of Senile Pathology, which virtually created the study of Senile Temperatures.

No part of our art can give a better idea of law in thermometry than the course of senile temperature, as traced by him, and developed by his élèves, Bourneville, Lépine, Goffroy, etc. Remarks on the effects of old age on the temperature of several diseases may have been here previously scattered; a few pages above this, when treating of insanity, cerebral hæmorrhages and apoplexy, it may have been noted that we were already threading the grounds of senile temperatures; and now I am conscious that I will not bring on this focus all what can illuminate it; but space admonishes to be brief.

In old people, says Marey, the heart is stronger than ever. But the temperature is not higher. Ustion—though supported by the ultime effort of a brave circulation—will not be equal to the eventual demand of a phlegmasia for more fuel for combustion; greedy of its resources, old tissues will not let out those degrees of heat which in youth proclaim and entertain abnormal combustions; old organisms have no such abundance of fuel to waste. They may, exceptionally—like in some forms of pneumonia—spend all their combustible in a rapid, progressive explosion; but in the majority of cases, after giving a feeble, though long or short indication of danger, the temperature collapses with the other symptoms.

The persistency of high temperatures, without well-delineated diurnal oscillations, constitute an important feature of lobular pneumonia, particularly in the aged. The écart from morning to night is .5° C. in lobular, and 1°—1.5° in catarrhal pneumonia. These signs are the more important in view of the difficulties which beset the auscultation of old patients. By it alone Charcot and his staff were enabled to *pose* the diagnostic of pulmonary inflammation at the Salpêtrière long before the ear could detect a stethoscopic sound of pneumonia. They

put down this movement as follows: The initial chill, almost like in adults, or rising slowly, as in broncho-pneumonia, where the acme is lower than in the lobar. An improvement succeeds, but does not last; the same evening or the next morrow heat ascends to 40°, 41°, where it remains five or six days with poor chances; otherwise it has descended slowly to 39°, with a more favorable prospect.

However, serious lesions are often represented by light symptoms, or no symptoms at all, except an unsuspected temperature. (See Pneumonia, p. 169, fig. 56, and p. 170, fig. 57.)

At other times the temperature expresses more the depression of vitality, or a complication of pericarditis, etc., than the pyrexy of pneumonia.

And let us close by this other discovery of Charcot, the *algide pneumonia* of the aged. This ordinarily fatal lesion is represented in the old inmates of his hospital by signs—the algidity, for instance—entirely opposite to those which judge the same cases in adults.

Tuberculization is frequent, but generally latent in old people. Phthisis is remarkably sly and insidious, may remain latent during its whole course, and be revealed only by the autopsy, if the alternations of temperature corresponding to fever or depression have not been mapped out.

Here, like in many other points, we have the indications of a man of genius, but nothing done with them, everything to do.

To extend this survey to many more diseases would not modify the general conclusions arrived at in senile temperatures.

In old people, the central temperature must be consulted more than the peripheric, and not so much in the axilla, which is too parched, as in the rectum, which answers better in average cases. Such is the advice of Bärensprung, Moleschott, Charcot; the latter having found that the difference of .2°—.3° C. in adults, between the axillary and rectal T. rises in old people to .7°—.8° C. He gives the case of a woman, æt. 103, axillary T. 37.25°; rectal, 38°, etc.

Still, let us make a broad reservation before summing up the rules; it concerns local diseases.

In the aged, as the different organs have got used to lead quite an independent life, not only local diseases become more frequent, but the general temperature is not, as in youth, so

easily, nor so completely involved in the thermic conditions of local phlegmasiæ; a double cause of error.

Therefore, in a local (or in a one-organ) disease of the aged, the fever-thermometer has often nothing to report; the surface-thermometer, too, separated from the seat of morbid processes by a dry skin, etc., may remain unmoved; hence, recourse must be had to the thermoscope, whose subtilty will denounce unheard-of, yet diagnostic differences.

Senile central temperatures may be noted as high—or higher (Bärensprung)—than adults; yet they cannot so long stand the wear of illness.

They may reach above the patient's norme, but the highest the shortest.

Any upward progression soon ending in death; any downward progression difficult to break; reaction null, imperfect or partial.

In senile temperatures daily fluctuations are stiff of motion, with a narrow excursus.

Their effervescence has no neat ascendancy.

Their acme no neat peak.

Their defervescence is too often a mask for collapse.

Their convalescence a slow process of local or general frigeration.

Their figures start from the norme, but their progression is downward.

Senile temperatures mean or portend apyrexy.

Senile diseases are, or become easily apyretic.

Generalities which must not only guide the diagnosis, but serve as principles of treatment.

a.—Temperature in Chronic Diseases.

Though young persons may be affected with chronic diseases, the latter appear almost the privilege of the old. I say privilege, since some of them seem to confer a brevet of longevity, which the sufferer from it enjoys the more as it appears to the looker-on the more insufferable. The temperature of chronic diseases, though subject to much diversity, not only in each disease, but in each of the acknowledged periods of life-long maladies, may, however, be brought to a sort of thermic classification: *a.* The

temperature of the morning and evening are not far from the norme, but the evening farther up; at noon it is either higher or lower than the morning's.—*b*. The morning temperature is normal or lower than the norme; the evening always higher or lower than the morning's. In this class are found those which constantly keep under the norme.—*c*. The temperature constantly above the norme; the evening's sometimes, at others the noon's temperature is the highest.—*d*. And, finally, the temperature may affect the march of an endless lysis, ending nevertheless in a collapse or collapses.

Infantile Apyrexy.

As life is in death, and death in life, so none looks so much like a dying man as a coming man, and the last gape like the first breath.

The child born with the signs of atavism brings with him the marks, even the stigmata of his ancestors' impressions. First, he continues the operation of breathing where they left it, at the expiration, by an inspiration; and the disease resulting mainly from this break, apyrexy by asphyxia, is the last of the old and the first of the young. Thus, at the two extremities of our present individuality the problem of human temperature is concentrated in the two alternate and rhythmic therms of expiration and inspiration, the diseases of the oldest and of the youngest resolving themselves in apyrexy by asphyxia.

The first diseases of the new-born—the last of which we shall speak—are mainly apyretic, *i.e.*, caused by algidity; and the varied movements of their temperature are the forms of the struggle for more heat.

Many children bring their own death in their own bosom with deadly central temperatures; others bring only—or mainly—exceptional peripheric dispositions to cooling; when others, born in the most excellent thermal conditions, are chilled down by the cold touch of neglect, or by want, to the level of the cold-blooded animals. In the first hours and days either of these conditions brings on diseases which—under whatever name—are apyrexy; and these children die chilled, being cold like death when yet alive.

Their frigeration may have commenced in the uterus, or

under the first smarting impression of our atmosphere, or, later, from several or complex causes. Unless in the extreme cases, it is not at first a disease, only a relative incapacity of keeping warm, or of generating warmth, easily remediable by hygienic measures as long as the body's temperature has not fallen more than $\overline{1}$=one centigrade degree below the norme.

But it is decidedly a disease, and it imperils life, when it causes the body-temperature to fall $\overline{2}$ (two degrees below the norme). In this particular our children do not differ from the young mammifers severed from their parents. However, care and food generally bring up the temperature of the new-born to its norme in twenty-four hours, simply because food is the main source of heat, and the natural buoyancy of life raises and keeps it up to that degree. But as soon as the temperature of a baby falls $\overline{3}$, $\overline{4}$, or 5 (three, four, or five degrees below the norme), he is in mortal danger, though he may live with a good deal less warmth; but how few survive will be seen. (Revert also to p. 17.)

(*a.*) Frigeration of the New-Born.

It may have begun *in utero*, being caused by certain conditions of the mother, sickness of the fœtus, etc.; or by a premature birth or a postponed one. Later it is induced by want, neglect, dirtiness, exposure, beside the rude impression made by the change from the watery sphere of the amnion to our sharp atmosphere; and as for the abandoned children, by the want of contact with the warm body of a mother. If a reaction (to be thermometrically watched) do not take place soon, decalorification continues the work of initial frigeration, and the consequence will be a true apyretic disease.

(*b.*) Infantile Algidity,

In which the temperature may fall to 34°—35.6°, averaging 34.75° C., where Brechét found it on the foundlings of Paris. There the death-rate of the first year was ninety per cent., showing how nearly synonymous decalorification is to devitaliz-

ation. In humane circumstances, however, the chances are much better.

When we see that the temperature of a baby is below the norme, without waiting to study the terms of a progression which may prove ascendant—but if descendant should be mortal—we must at once settle the question of the character of the apyrexy by the very means which can best both correct and test it. Did the frigidity initiate from the inner child or from outward circumstances? Is the fall of the temperature due to a deficiency in the production of caloric? or to an excess of its escape? In other words, what is at fault?—the warmth-producing, the warmth-retenting, or the warmth-harmonizing processes? Happily food and thermometry altogether are able to solve these questions, and to mathematically manage the cure.

Thus, thermometry, finding a flaccid and weak infant with 36° C. $=\bar{1}$ Ph.; good food being given, followed by a good sleep, he will in two or three hours awake with a normal temperature. His case was one of incipient frigeration of external origin. But if the thermometer descends to $\bar{2}$ (two below the norme, $= 35^\circ$ C.), it indicates dereliction of duty in the nursing, or a semi-starvation by inferior food. The consequent apyrexy will have acquired the inner force of a constitutional habit; a single meal will not have the power of raising the temperature, but a series of good meals and judicious bathing will in a few days. In the first case it was frigeration, in the second algidity. (See W. Squire, *Infantile Temperature in Health and Disease*, and our Chapter IV., pages 17 and 18 on the causes of infantile algidity of $\bar{1}$ to $\bar{2}$ degrees (below the norme).)

But this is not the last stage, nor the worst form of infantile apyrexia. We find them in Roger.

(*c*.) Sclerema,

Or, *algid œdema neo-natorum.*

In sclerema the child is like transformed into a cold-blooded animal: (*a*) temperature low, (*b*) circulation slow, (*c*) respiration imperfect, (*d*) mobility neutralized, (*e*) cellular tissue indured. Most of these disorders, at least their ensemble, are

pathognomonic, but which of them precede and act as a cause to the others?

The experiments of Chossat on animals, of Squire, Roger, Parrot, Mignot, on infants, give the precedence to the anomalies of temperature; the latter says: "*l'algidité precède l'œdeme,*" etc.

But setting aside authorities, let us see the reasons why sclerema is essentially one of our subject-matters. Because (a') the lowering of the temperature is the first symptom noticed, and always present; (b') the pulse generally slow (70—60), often insensible at the radiale, appears sometimes little or not affected; (c') the respiration, ordinarily fallen to 20, 16, 14, remains sometimes in the neighborhood of the new-born's norme, 39; (d') the inpairing of the motility is not always noticeable; (e') and the induration of the cellular tissue, always an eminent symptom, never precedes, always follows, the fall of the temperature. Another and experimental proof of the causation of sclerema by apyrexy, and of the secondary character of the other symptoms, is that the means which we rationally use to raise the temperature, improve the other symptoms consecutively and proportionately to their pyretic action.

Sclerema is therefore a primary *algidity*, aggravated by progressive *frigeration.* Hence its fatal tendency, thermometrically written in a progression, and rarely in an intermittence; as per examples:

Days.		1	2	3	4	5	6
Parrot	progression descendante ...	31.8	28.8	26.4	24.8	Death	Death
	intermittent...	30.8	26.3	25.7	Death	"	"
		32.4	"	"	26.8	29.5	(the last)
Roger	progressive.... ascendant.....	33.	33.	34.5	Cured	"	
	progressive......	33.	29.5	22.	(the last)	"	
	descendant......	32.5	"	28.25	26.5	24.	

For a full view of this downward movement, see Appendix XIX., *b*. If we compare these temperatures with the average at birth (37.8° C.,=.8 Ph.) of the same author, one is struck with

the fatality and rapidity of the descent, and the incapacity, not only of medicines, but even of intercurrent inflammations, to bring the temperature to the normal point: the body cools in virtue of a negative force, *vis negativa.* If we compare this with the apyrexy of inanition, their march differs entirely. By the privation of food the temperature falls .3° C. every day; but the last day hundred times more. And why? Because the subject of starvation feeds himself with his own substance by *autophagism*, and thus keeps up his ustion as near the norme as he can. But when his inward reserve of combustible has been combured, then the tissues themselves cool like ashes: a phenomenon named by Trousseau, which we must always have present in our mind when reckoning temperatures in protracted diseases. (For the local algidity in gangrene of the mouth, see, without commentary, the same Appendix XIX., *a.*)

Roger saw very well that sclerosis was an improper name for that essentially apyretic condition; but instead of calling it by its name *algidity*, and qualifying it by its most apparent symptom *œdematous*, he named it *œdema*, and qualified it *algide:* sooner the result of timidity than of error; since, with force and sympathy, and disregarding his own nomenclature, he directs all his treatment against the *algidity.* In presence of his loss of twenty-seven out of twenty-nine young patients, he reverts to the physiological experiments of Chossat, who—more successful with animals than we are with infants—recovered three out of his six cases of refroidissement by starvation; and concludes that *algide œdema* must be treated (*a*) in warmer milieux, (*b*) by warmth-producing food, according to Chossat's axiom: *La caloricité perdue se retrouve par la digestion.*

Conclusion of Temperature.

This survey of the temperature of man in its normal conditions and in its abnormal *peripeties* has been long, possibly tedious, but surely instructive for those who read it in the spirit in which it was written.

We have seen human temperature in infancy difficult to settle to its norme, because either ill-supplied by a nascent calorigenation, or wasted by ill-regulated deperditions, it was often incapable of keeping pace with its sister-functions, circu-

lation and respiration, and presented, in health, deviations which would later be considered as grave, sickly *écarts*. We have seen children dying mainly from generating too little, or from wasting too much of caloric.

In youth, disordered temperatures warn of peril, either sudden or progressive, according to their succession, and to their relations to the anomalies of other functions. In manhood, a normal caloricity presents the surest guarantees of longevity and of success under proper management; it is the highest expression of life prior to its conversion in measurable work, and in imponderable forces, thoughts and ideas. Its fluctuations indicate uncertainties and danger.

In old age the temperature is supported about the norme by two senile processes: the effort of the circulation, which, as it grows weaker at the centres, appears stronger at the periphery, because it sends forth all the available blood in order to keep up the body-warmth; at the same time that the hornified skin—not unlike the purse of a miser—has acquired a retentiveness which almost forbids radiation and perspiration.

By this double husbanding process, *le vieillard* keeps a sufficient caloricity, till the demand of some accidental phlegmasia is met by the absolute impossibility of more heat-supply. Previous wastes and squanderings have broken the balance, and the body is soon cooled down to the level of ambient matter.

Thus old people present pretty near the same circulation and combustion as adults; but potentially what a difference! Let almost any morbid condition supervene, and you will see—after Charcot—that the pulse, instead of expressing the modality of the circulation which belongs to the present disease, continues to beat hard but empty-like; and that the temperature, instead of taking to the rhythm which pertains to the *intrent* disease, remains as unmoved in the neighborhood of the norme —the more normal in appearance, the more critical in reality—and soon resolves itself by simple *devalescence*, without fluctuations or struggles, into lethal apyrexy.

Now, at the end of our topographic survey of temperature, whence originates human *calor?* . . .

As on trees every year's growth leaves its foot-print in the pith, the lignum, the liber, and the cortex, so in the nervous system the progress of evolution, through ages in our minds, and through the various forms of life under our eyes, is marked:

(*a*) by the development from the single cell expressing its sympathies through radiating fibrillæ, to the circular plexus of ganglia—little brains of Hartley and Winslow—communicating the same order of feelings with electric swiftness; (*b*) by the addition of a double rectilinear chain of closer ganglia, propulsor of onward movement and generation; (*c*) by the crowning efflorescence of the convolutions and other special organs of sensation, memory, comparison, and rational determinations.

Such is the *trinary* origin of the *unique* human nervous system. So complex is the interdependence of these parts anatomically and physiologically, that when we look for the attributes of each in the functions, we are able to give up the problem; and if we consider the claim to superiority of the apparels of the great functions—assimilation, sanguinification, circulation, respiration, etc.—we find them equally necessary to man, and, like people who, having no self-control, elect a master—to say the head is king. But if we inquire into the primordiality of one of the three forms of our nervous system, we arrive by induction at conclusions, which have already been prepared by the most searching analysis.

Considering first the biologic evolution of the nervous organism, we see, as if it were through eternity, the physiological *calor* developing from the automatic ganglia, cause and effect, cell-life.

Then the immense impetus and universal fecundation swarming from the almost acephal gigantic spine, which spawned all over the world ichthyosauri, saurians, placoïds, etc.

And laterly, in the cerebral period, the reign of intellect, during which mental activity changes the face of the world, *mens agitat molem*—with the drawbacks due to excess: (*a*) rapid exhaustion of the surface of our planet by the mismanagement of its reserves of caloric and other vital resources; and (*b*) for individuals, paralysis, idiocy, insanity, cancerous and cerebriform outgrowths, and the various forms of consumptions resulting from inordinate combustions.

From this standpoint the great sympathetic appears to initiate caloricity—which really it distributes by an action called *reflex* from the now prevalent theory of its procedure, but to which the qualification of *sympathetic* would be much more appropriate, considering the nature of its impulse.

This has not been overlooked by the masters. Currie, as

great in theory as in therapeutics, insisted on the influence of feelings on temperature. Larrey, Percy and Dupuytren relied on this influence in their field practice, as we all implicitly do at the bedside. Cl. Bernard, Schiff and Brown-Séquard demonstrated the same in the laboratory by causing tears, saliva, and other secretions to flow or to dry, blood to afflue or to retire, central heat to rise or fall, local radiation to burst forth, or clammy cold to set on a predesignated spot at a single touch, pressure or severance of some part of the sympathetic—phenomena of which the encephalon is as innocent as of the act of digestion. Likewise, moral—that is sympathetic—determinations, stand reciprocally as cause and effect in their relations to temperature: fright lowers it; distrust keeps it down; joy, ire, hope, love, rise or equalize it; even confidence and fortitude will keep the norme up against the assaults of malaria and epidemics; and conversely, as long as it has heat, the lone cell is capable of determinations as strong as the Kaiser's.

In other terms: between health and disease there is no difference in kind, but in degrees—only disharmony; no new products, only exaggeration of produces. Physiology cannot yet explain everything, but what it has explained is in conformity with this principle. There is not two kinds of *calor* (French, *chaleur*), one morbid, the other healthy; nor one physic, and the other physiologic—any more than a physical and an animal electricity, both being capable of condensation by the same process.

There is no special calorigenic organ: as all the tissues and organs are self-feeders, all produce *calor;* calorification is a universal property; but the regulation of this property is intrusted to an apparel, the sympathetic. There are vaso-motor *dilator* nerves, there are *constrictor* nerves; the dilators are *calorific*, the constrictor *frigorific.* Independently of this action of the great sympathetic through the vaso-motors, it has two other direct ones: its excitation (by sensations, etc.) is frigorific; its section, paralysis or suspended action, during fever for instance, is calorific; conversely in cholera the exaggerated frigorification of the great sympathetic brings *algidity*; at death (when this action ceases) the temperature *rises*, sometimes enormously.

The great sympathetic is the centre of frigeration and of sensibility; pain (*dolor*) raises at first, soon and permanently

lowers it. Moral excitations are phenomena of sensibility centralized in the sympathetic. Fear acts like pain; wrath, shame, act on the pupilla, the blood-vessels and the heart. The reaction of the moral on the physic is a simple physiological phenomenon; a psychical pain (*dolor*) acts on the bodily economy as would the painful, mechanical excitation of a nerve; both have for agent the great sympathetic, and carry with them perturbations of nutrition, organic lesions, and the most varied diseases.

Having followed human temperature from its norme to its most eccentric modalities, and seen that at all ages, and in all circumstances, it appears as the primordial element around which are grouped the principal functions, as circulation, respiration, nutrition, the sensory and mental operations, we have come to consider *calor* as identical with life. And we conclude that, in disease as well as in health, during the individual existence, or in the transit from a definite form to the *milieu* universal, and in the resumption of definite forms again, *calor* is the ultime perceptible phenomenon between "to be and not to be."

For the physician, the keeping of the body's norme is equivalent to keeping alive. For the psycho-physiologist heat is the synthesis.

La chaleur c'est la synthèse.

PART SECOND.

HUMAN THERMOMETRY.

PART SECOND.

HUMAN THERMOMETRY.

CHAPTER I.

THERMOMETRY is the analysis of human temperature; one of the three instruments—chemical, thermal, and spectral analysis—which actually revolutionize not only physic, but physics. It is born of the conjunction of thoughts of many generations, whose brain deposited the muck in which the idea of Hippocrates was fecundated by the invention of Sanctorius.

Thermometry is an art, adjunct to the medical, which has its instruments and their manual, and is almost a science, having its vocabulary, and its methods of taking, recording and reading observations, and, like all arts and sciences, is susceptible of growth or of decay, according to our neglect or cultivation: if we do not improve it, it will deteriorate. This is no theoretical assertion, but the expression of an historical fact. When the monks of Upper Egypt invaded Alexandria, knife in hand, killing savants to reach science, in order to give the undisputed practice of medicine to their brothers therapeutes who cured—as to-day at Lourdes, at Notre Dame des Victoires, etc.—by the saints, the relics and the amulets, there was an art of *physical diagnosis* comprising bodily mensuration, inspection, palpation, percussion, concussion, succussion, etc., and at the summit of this art a complete system of local and central thermometry. The records of that art soon perished, after the art itself—not

by the hand of Omar, but much earlier, in the wars which the spiritualists waged against physical sciences (see Sprengel's History of Medicine, I., II., III.). A single monument remained of the existence of the physical diagnosis and thermometry of the ancients, so touching, romantic and sovereign, that it was impossible to deface it from the memory of men. It was therefore most infamously travestied. Impossible to suppress the world-famed narrative of the love affair of Antiochus with the second wife of his father, as discovered by Erasistrates, and told by Appian Alexandrin in his *Syriac Wars*, but it was possible to distort it so that its medical bearing would become incomprehensible.

"Antiochus, son of Seleucus, King of Pontus, having become madly enamored of the beautiful Queen Stratonice, wished to die and was actually fast declining. Erasistrates, the illustrious professor and friend of the royal family, tried to recognize his disease by its physical symptoms, *manipulated and inspected his body in all sorts of ways, and looked through its parts*; but failing to see any trace or indication of illness, or of corporeal infirmity, judged that it was not a disease of the body, but of the mind. Having next ascertained that the youth would not tell the truth, Erasistrates determined to find it out, sat by him, and watched for hours. Antiochus did not move, nor changed expression, nor gave out any other sign of emotion, remaining dull and absent-minded for any one, but for the queen. No sooner had he seen her stately form moving in, than he changed altogether in color; his body would rise from prostration, and *the glow of heat be perceptible all over it.* But as soon as Stratonice had left, he would fall again in his *cold prostration and indifference.* (Here comes the never equalled artifice of language, by which the physiologist persuaded the king-botanist—founder of the zoological gardens of Pergamos—to relinquish the beauty to the youth. But this is beside our subject. What belongs here is the fallacy which represented in history and in art Erasistrates diagnosing the condition of Antiochus *by the pulse.* If the pulse could do that, of what use palpation, succussion, mensuration, manual thermometry, anatomy, experimental physiology? . . . Even circulation was cut off—as nonsensical—at the wrist. And likewise to-day numbers of people would shorten thermometry to its clinical functions, while others would even narrow its use

to the measurement of pyrexiæ with a *fever*-thermometer; and how few begin to consider it as a measure of vitality in all the circumstances of life, as a biometer.

The mind of Wunderlich, not limited by his hospital wards, embraced in his admirable *Manual* this idea of a thermometry larger than the purely clinical. He said in his preface: *Theoretical questions as to human temperature and kindred subjects must not be overlooked, and well deserve to be explored.*

a.—This anticipated protest against shrunken apathy set him on a different level from the *practical* men who excommunicate ideas without thinking what would the world be, even in the most common affairs of life, without the ideas of only the last year. Wunderlich knew that nothing is nearer the status of fact than a germinating idea, even than the facts of to-day themselves. For no sooner is *a fact a fact*, than an idea has already crept on to alter it and create its substitute; so that there is really and substantially more practicality and positivism in the idea of to-day, which will be the fact of to-morrow, than in the fact of to-day, which to-morrow will be dross.

b.—Happily, that wish of this most practical physician shall not remain unfulfilled. Thermometry is the question of the present hour; towards it all foreseeing eyes are turned. It is irrevocably wedded to medicine by its force of prognosis and diagnosis. By the mathematics of its data, and the positivism of its method of observation, it has already discovered the normal point of human health, some laws of general pathology, and not a few of special therapeutics. Beyond this it has identified physiology with the other physical sciences, by rendering mathematically demonstrable the influence of the nervous system on the distribution of warmth, the disengagement of heat by muscular contractibility, and the convertibility of human heat into physical and intellectual activity.

This and more has been done in a few years, by a few men, with instruments made for another kind of work. But who knows what medical—human, must I say?—thermometry could do, when the simplicity of its procedure, the adaptability of its instruments, the number of its devotees will permit its application, not only to the treatment, but to the prevention of disease, and especially to the supervision of the training of youth.

Then we shall begin to understand that, for physicians, thermometry is not only knowledge, but social power.

c.—It is only very recently that thermometry has become the generally acknowledged means of diagnosis we know it to be. De Haen could condole with his townsman, Avenburgger, upon the indifference or malignancy* of their confrères in regard to scientific improvement. Yet the discoveries of these never too much to be honored men stand to-day for nine-tenths of diagnosis, in lieu of the old methods founded on conjecture and authority. To-day Percussion and Auscultation occupy the highest place in Physical Diagnosis, just as Thermometry soon will in Positive Diagnosis: though few men live to rest their heads under the tree sprung from their imagination; no seeds grow so surely as those of the mind.

d.—Thirty years ago *Physical Diagnosis* had no name; now its teaching fills volumes. To-day the name of *Positive Diagnosis* is almost unknown, yet soon it will grow out of the parent stock, by a process of gemmation (budding), natural or artificial, into organic life, a process becoming frequent in science. It would be difficult to conceive what the practice of medicine *would be* to-day without Auscultation, Percussion, Thermometry, and the host of other means of physical and positive investigation; but it would be more difficult yet to realize what it *will be* after thirty years of close adherence to the laws of observation, of education of the medical senses, of training in the manœuvres of the instruments which give more delicacy and extension to the operations of our senses—the stethoscope, ophthalmoscope, endoscope, etc.—instruments of *physical diagnosis*—and in the handling of those which perceive and report mathematically the phenomena which our senses cannot reach—microscopes, thermometers, æsthesiometers, sphygmographs, thermographs, myographs, thermoscopes, and spectroscopes—instruments of *Positive Diagnosis.* But we can already affirm that then physicians will be nearer physicists and farther from metaphysicians than they now are, and that physic will have completely reclaimed its place among the Natural Sciences.

The world has a critical eye upon the medical profession for that.

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* See Avenburgger on Percussion, etc., in *Præfacio.*

Of all recent improvements none will be so potent to give medicine a place among the Positive Sciences as its adoption of Thermometry.

e.—But several *moves* are necessary to attain this object. The hand must be educated to take a larger part in diagnosis. The thermometers must be adapted by their scale and shape to human temperatures and forms. The temperature must assume in diagnosis the paramount and central place too long occupied by the pulse. The method of registering temperature as the centre of the other symptoms must be agreed upon, and its records readable by all as easily as the news in the daily press. Thermometry must occupy its place in the family, school, insurance office, workshop, prison, army, navy, as it does in hospitals; and in philosophy and social science it must, according to the far-reaching expression of Wunderlich, "*Explore the theoretical regions of human temperature.*"

The author cannot expect to accomplish all this; but where he stops others will advance.

CHAPTER II.

INSTRUMENTS OF THERMOMETRY.

HIPPOCRATES did not consult the *pulse*, but measured the *fever* by the *heat*, which he studied by palpation all over the body; even by localized thermometry, since he said: "Le médecin examinera, si un des côtes est plus chaud que l'autre." (Littré Translation, T. II., p. 133). So thermometry did not begin with Sanctorins' instrument, nor can it be limited by ours, whose mathematical precision must not make us distrust and dismiss the *Hand*, reporter of heat, and of other accessory qualities of the living tissues besides; rather should this invention stimulate our ambition to perfect our *natural thermometer*, so that it could in some respects complete, in others control, the results obtained with automatic instruments.

I.—EDUCATION OF THE MEDICAL SENSES.

The time is not far distant when the instructors of youth, instead of considering the perspicuity of the medical senses as a personal attribute, will educate them as normal faculties, which must be brought in physicians to the highest point of efficiency; whose object, far from being the elevation of a few favorites of transient fame, will be the education of a sufficient number of efficient and reliable practitioners. Then—that is to say, soon—will be organized courses of training of the Ear, to hear and listen; of the Eye, to see, look, discriminate, or scrutinize, to embrace totalities or to concentrate on details, etc.; of the Smell, to detect odors, smells, effluvia—of which there are too many in hospitals—and to classify them as the most subtle yet sure elements of prognosis; of the Tact, to enter into communication, by every nervous fibrilla peeping behind the pores, with the tangible properties of tissues, superficial and

subjacent, to warn the mind against hasty judgments, to correct erroneous impressions of the other senses, and, above all, to measure life itself by its first and last expression, the evolution of caloric.

I have claimed before the American Medical Association for the medical students the right to this training. Not by the trial of pluck and knuckle on the chest of the pleuritic or consumptive to begin with, but by a systematic course of exercises on non-living bodies calculated to gradually elevate *the perceptive functions* to the rank of *intellectual capacities.* And I now urge—to narrow this vast subject to the point at issue—the necessity of the training of *the sense of tact, concentrated in the hand, to its highest pitch of delicacy, in view of its application to human thermometry.*

a.—Hand-Thermometer.

The hand is a thermometer that rich or poor, educated or ignorant, we cannot help carrying with us anywhere. It gives —besides an idea of the temperature rendered more and more accurate by education—a knowledge of the concomitant properties of the parts under exploration, as tension, dryness, etc. It does not give a mathematical account of the temperature; but by simple *apposition*, by slight, deep, or profound and methodical pressures, it can make us appreciate more difference in the pyrogenic conditions of the cutaneous, infra-cutaneous, and deeper regions, than any other mode of exploration, even more than the simultaneous application of the fever and surface thermometers. Moreover, the hand is the instrument of a sense —the tact—which improves by use, rarely loses its virtue by accident, and in many circumstances can be, and is substituted for the other senses in observation: for the sight, so early and easily impaired by use, by excesses, even by hereditary tendencies; and for the audition, so often incapacitated for clinical purposes by accidents or by diseases like scarlet, typhoid, and other fevers; and not so soon, but as surely, by age. The necessity of this substitution of one sense for another is particularly felt by the young physicians who have contracted one of these contagious or epidemic diseases which blunt the powers of perception of the ear, eye, smell, taste, singly or collectively.

These confrères, more numerous than is supposed, and intellectually above the average, would have to quit the profession if they could not substitute the perceptions of the tact for those of the other senses in diagnosis.

Therefore, to urge the necessity of the medical training of the hand, is equivalent to advocating the addition of several instruments to ours, particularly of a thermometer of which nothing but paralysis can deprive us.

As the eye of a physician must read more easily countenances than books, so his hand must feel with the sensitiveness to contact of an aërometer.

In the exercise of this feeling the hand has to perform at least four operations*—the approach, the touch, the tact, and the pressure; distinctions which must be maintained, or extended farther in some of the training exercises, and laid aside in others.

The physiological exercises of the hand naturally bear upon the properties it will have to discriminate when called to act as a thermometer: heat, moisture, surface, configuration, dimensions, tension, elasticity, etc. Most of these exercises must be performed by the hand unaided by the other senses, sometimes like playful games,† at others by concentrated efforts of attention.

For instance of what is not done, and what can be accomplished in this form of training of the hand: great pains are taken by professors to teach anatomy *viva voce*, and by students to listen and read about it. Others teach anatomy *de visu*, showing the pieces they vainly try to describe by words. But how much more effective would be their teaching if it was done with less words, but *de visu* and *de tactu* altogether, and *de tactu* separately. The form of a bone cannot enter the mind through the ear, is even imperfectly delineated on the convolutions of the brain through the retina, unless color is added to form; whereas, through the poly-surfaces of the tactile papillæ, its form is like molden in the sensorium, where it will rest, not like an image, but a cast.

Why, then, not teach that part of anatomy, and natural his-

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* See *Transactions of the Am. Med. Assoc.*, 1873, vol. 24, page 187, etc.

† See *Manual of Thermometry for Mothers, Nurses*, etc., pages 6 and following.

tory at large, through the sense of touch, which would soon become for all physicians what it is for the privileged few—the *tactus eruditus*, companion and interpreter to the *mens eruditus*.

By these and similar exercises bearing on the temperature and other properties, the hand of the physician—but why not that of all educated beings?—would conquer the capacity which constitutes the superiority of many insects over man—the capacity of feeling, natural in the antennæ, potential in the hand.

This organ, so prepared, would be more than equal to the exigencies of thermometry, whose technicalities would soon be mastered.

b.—Manual of Hand-Thermometry.

The hand being in working order; that is to say, its feeling capacities well developed through a smooth and sensitive surface; its cleanliness unimpeachable, not only from actual impurities, but even from suspicions arising from contact with previous patients; its temperature made isothermal, or equivalent to that of the surroundings, which is easily tested by shaking hand, or any other means of comparing temperature with those present—then the manœuvres of the hand-thermometer are conducted in the following progression:

The flat of one or more fingers, or of the whole hand—according to the size and configuration of the surface to be explored—remains hovering a while above and near, to perceive the heat exhaled therefrom; then enters upon a slight contact with this surface to receive the impression of its most superficial temperature; then by a firmer pressure receives the full impression of the skin's temperature; then by gradually deeper pressures acquires the impressions of deeper and deeper seated combustions. Every one of these pressures should be made separately, after the impression of the former has distinctly reached the mind through the inquiring hand. Then the hand is gradually and slowly removed, in order to appreciate these different modifications of temperature in inverse progression, or rather in retrogression.

But this manœuvre would give imperfect results, if only applied according to this general indication; whereas its results

could be made faultless by the previous teachings of the anatomical sense of the parts to be explored, and moreover by the anticipation of the pathological anomalies to be encountered.

If we wish, for instance, to watch over the temperature of the head of a child—in which operation, by the by, the hand offers several advantages over any instrument—a kind of spherical application of the hands to its surface would teach very little; an adaptation of them to the parts, taking into account their topographical anomalies, would discover more; and an intentional—I would sooner say interrogative—pressure over some parts suspected of being in an abnormal state: the parietal sutures during dentition; the superior fontanelle in the first and second summer, or as long as it is bulging by day, depressed by night, and pulsatile part of the time; at the temples during the committing of lessons to memory or their recitation; and at the base of the head, when there is a tuberculous diathesis: these manœuvres—now committed to the pulp of the finger, then trusted to the palm of the hand as to an impervious retainer of escaping caloric—would transmit thermal impressions, whose mode of escape, continuity, and localization should be incontestable, and whose meanings could not be challenged.

Without looking for other illustrations, this will suffice to support the affirmation that the hand, to become a *meter* of heat, must, like the organs of the other senses, have received its physiological education. Still, however perfect may be the result of this sensory training, as there is no possible mathematical scale to measure our feelings upon, the hand is not expected to work as a graduated, but as a differential thermometer; nor to take the place of the former, but to call for its timely assistance: positive records of temperature being the exclusive work of mathematical instruments.

II.—Clinical Thermometers.

Nothing is known of the first instruments of Sanctorius, Boerhaave, Van Swieten and De Haen. They must have been, like those of Currie, Davy, Donné, Demarquay, mere weather-thermometers. They must have been pretty scarce, since Roger rather prides himself upon having secured the one of

Donné for his observations on the temperature of children, published in 1844.

Becquerel, Gavaret, Helmholtz, and other physiologists used thermo-electric apparatus inapplicable for several reasons to ordinary practice. Bouillaud and Piorry were the first who tried, to my knowledge, to construct theirs in view of taking both central and peripheric temperatures. I have seen the one of Bouillaud—a clumsy thing, of which he is proud, and justly too, since it is the unique relique of the first idea that physicians must have their own instruments. But this failure of the form was nothing compared to the error of the ideal looked for in their construction. For the worse form improves by successive adaptations, that is unavoidable; but once starting from wrong premises, the more you go, the farther you are from your objective.

a.—The False Principles.

Medical thermometry began with false notions; the worst ones being that a single thermometer can do the whole clinical work, and that any scale will do.

The first of these errors has prevented the methematical study of the anomalies of ustion in fevers, cholera and the other diseases characterized by large discrepancies between the central and the peripheric temperatures. The want of good surface-thermometers has certainly kept us backward in that matter at least thirty years.

The second error has allowed to grow side by side several scales, whose comparison obscures the subjects it pretends to enlighten, and demands a time which we cannot afford. Physicians do not alone suffer from this public nuisance. During the forty years Humboldt was busy tracing his isothermal line around the earth, he complained of nothing but the useless labor inflicted on him by the dry task of establishing the concordance of the various thermometric scales. Berzelius suffered as much from the same anarchy in his undertaking to establish a uniform scale of temperature in the vast domains of chemistry; and Arago rose—how many times! . . . from his seat of Secretaire Perpétuel de l'Academie des Sciences—to protest against that Tower of Babel, more potent in its tiny glass

tube to cause the confusion of languages than likely was the huge pile on the plain of Shinar.

But all in vain. Glovers, shoemakers, gas-fitters, have agreed to common standard measures upon which their work may be duplicated, mended, adjusted all over the world; manufacturers of pyroligneous acid and others have displaced the zero of the centigrade scale to suit the requirements of their industry; astronomers and seafaring people want a *meridian unique* and a common nautical almanac, in order to save labor, and thereby those errors of computation which cost many lives on the ocean. Indeed, savants, chemists, manufactures, mechanics, seamen, all strive to establish a standard measure of their work; all but physicians, who agree only to continue to disagree.

Under these unfavorable circumstances, a small number of physicians, with borrowed tools and an indomitable perseverance, began (1835-55) to extract the elements, principles, and laws of human temperature from the chaos of figures juxtaposed as equivalents from Fahrenheit, Reaumur, and Centigrade.

As on a battle-field, many lives have been spent since five and thirty years in taking temperatures, reducing one scale into another, writing figures, drawing curves and diagrams, summing up the products of the most intricate traces into general laws of thermo-physiology, and special laws of thermo-pathology, which will pass, like so many victories, to posterity under the name of General Wunderlich and others, who evolved the truth from the million of observations of the thousand nameless observers.

This was good to begin with, in the heroic times of thermometry. But since this mode of diagnosis has become popular, we shall have to simplify and multiply its instruments and methods of recording observations, to lower it to the vulgar heroism—heroism yet, after all—of the daily laborers in physic, who are willing to use the new method of diagnosis, provided it is made as expeditious as it already is effective. Let us, therefore, admire the monuments of the Titanic period of thermometry, like the Treatise of Wunderlich *On the Temperature in Disease*, etc.; but entertain no illusion as to the fate of medical thermometry itself. Thus presented with its unavoidable escort of millions of facts, and with diagrams whose curves could com-

pete with the waves of the ocean; and moreover represented by instruments which have no concordance among themselves, no near relation to human temperature, and no adaptability to the various parts of the surface of the body, whose temperature is so often the thing looked for (as in intermittent fever, for instance, where men like Wunderlich are reduced to guess about the difference of surface-temperature of the trunk and of the extremities), the present mode of taking and recording clinical thermometry makes upon the mind of a practitioner, first, an impression of awe, second, one of disappointment, which too often is the last one.

Such being the principal causes why medical thermometry has been and would remain a sort of arcanum among the hospital chiefs of service, who can command the labor of a large and intelligent staff, instead of extending the benefits accruing from its immense diagnostic and prognostic values to the whole profession, thence to the sufferers at large; I, for one, conceived that it would be of great honor to my profession, and of great benefit to my race, to render medical thermometry so easy that its use could become general, and could be extended to the solution of social and economical problems far more important than those of individual disease and recovery.

The simplifications—which I proposed for the first time eight years ago and are accepted as fast as old routine permits—bear upon the instruments of observations, upon the method of recording observations, and extend to new and important objects of general interest. But before coming to this, let us only see how the question stood a few years ago.

b.—Variety and Sameness of the First Improvements in Thermometers.

We have previously remarked that physiologists and physicists, aware of the shortcomings of the weather-thermometer to measure animal heat (*la chaleur animale, la chaleur humaine*), had made several trials to improve them. These first essays bore on the form and material of the instrument, but did not correspond to its various destinations.

Of the material, we have only one word to say. Only two

substances obeying thermal changes were thought of—alcohol and mercury.

Alcoholic thermometers were early made by Fastré for Cl. Bernard, and worked very well in the physiological laboratory as well as at the clinic. The same skilful engineer made (with alcohol) the tetracentigrade instrument of Walferdin —a thermometer having a 400° range, and a capacity for division of fiftieths of a degree—which deserves a *re*-consideration. Alvergnat Bro. made for Potain an excellent alcoholic thermometer, which is called by the latter's name; and others were manufactured in Germany and England by men of lesser reputation.

Yet they did not take. For two reasons: first, a moderate movement breaks the continuity of the column of alcohol in the tube, and therefore displaces its top level. It is true that by applying a match to the bulb, as Fastré showed me, the alcohol after striking the top of the tube comes down in an uninterrupting column, with its unique level at the right place. This mode of correction, though very simple, failed to render to the alcoholic thermometer the popularity it deserves for its cheapness and easy reading of fractions. The other cause of the neglect of alcohol was the invention of the index—a philosophical improvement realizable only with mercury.

Before coming to this, let us intercurrently say that though the Germans did not invent (in the medical sense) any thermometer, they contrived some way of inserting a printed scale between two glass-tubes; which made them so cheap, that for a few shillings the poorest practitioner could work with instruments concordant with those of the Traube, Thierfelder, etc.; an immense advantage where a concordance in the results of observation is the main desideratum (Leyster's, of Leipzig, thermometers).

By this time England had hit a more scientific improvement. Aitken had suggested to L. Casella the formation of an index which would reach the maxima of temperature, and remain there when the bulk of the mercury goes down; that is the idea of a *self-registering* thermometer, whose realization permits the physician to read temperatures which he cannot witness, and to read those he witnesses at a safe distance from the body and bed, focuses of contagium.

However much we admire the index of the self-registering

thermometer, we must not blind ourself to a defect which does not alter its habitual use, but absolutely impairs its usefulness in cases of exceptional apyrexy. In these rare cases—but the more interesting to study for their rarity—the self-registering instrument absolutely refuses to let go down the index as low as the temperature may go itself, in cholera, or in the apyrexia of the new-born, for instance. Besides, the short proportions of our pocket-thermometers do not permit to run their scale so low, neither so high as go some rare unexplainable hyperpyrexiæ. For this material reason, and for the moral one that once in a while we must keep secret certain dangerous temperatures, I think every physician must possess a Walferdin's thermometer (alcoholic), which could be set to work in a range of five degrees at any point of its immense scale of 400°, and will mark accurately the 10th and even 50th of degrees known from the physician alone who has prepared the instrument.

Another improvement came as a corrective to a material defect in the construction of the index. This defect was the too great ease with which the index came down in the reservoir and lost itself in the bulk of the mercury—thereby ruining the instrument—gave rise to the devices of strangling or twisting, once or twice, the neck of the tube at its exit from the bulb, so that it would be hardly possible for the index to find its way to perdition in the mercurial mass below. For another material improvement, the degrees were engraved on the glass, and other finishing touches were given, which made the English thermometer popular where money is no object.

To the credit of England is also due the initiative of asking the control of the savants of Kew for the best of her clinical thermometers. This guaranty was first demanded from the royal observatory, and offered to the medical public by L. Casella, if I am well informed; and other houses offer now the same surety, which promises well, but is yet *sub judice.*

Such a resort to authority by a nation to whom commercial freedom is a religion, bespeaks of the grave difficulties encountered in freeing from inaccuracy the best (yes, relatively the best) thermometers in the world.

As England issues several thousands of them, and we—who did not import fifty a year in 1867—need now more than three thousand a year for home use alone, these defects, these im-

perfections and their correction, are matters of money and of science, and must be looked in the face.

c.—Inaccuracies of Thermometers.

We let alone the defects resulting from a greedy manufacture, which are sure to bring their desert. The imperfections of honestly and skilfully made mercurial thermometers may be summed in one, *i.e.*, the change of relations (*rapports*) which intervenes between the glass and its contents. This is partly due to the shrinking of the glass, and partly modified by the settling of the mercury under barometric pressure. It is a slow double process, during which the level of the metal fluctuates with a strong upward tendency. If thermometers are marked prior to, or during this movement, the level of the mercury does not remain in concordance with the figures of the hastily engraved scale. Errors are soon discovered, of .5°, 1°, 2° C., which mislead the more, since they are themselves subject to variations. These variations consist, on the main, in a rising of the level of the mercury, sensible during the first six months, mathematically measurable for at least two years.

This being physically and unavoidably the case, it is evident that no scale must be affixed to an unfixed level; in other words, *thermometers must not be graduated before their elements have* harmonized. It takes two years at least to settle these elements of clinical computation; by what process can it be done? We have not here a royal institution of universally acknowledged authority; and even if the Smithsonian Institute, the Technological School of Hoboken, the Colleges of Columbia, Harvard, or Yale, were offered this verification, it is doubtful if they have the means and the men necessary to effect such a vast control.

d.—How to make Thermometers correct.

But considering that the difficulty resides, not so much in the skill of the instrument-maker, as in the time allotted to the elements to settle, it seems possible to obtain the latter guaranty without restricting the freedom of workmanship. There are many ways of doing it, and if I must suggest one, I would say: Let manufacturers *set up* their thermometers (with number

and trade-mark) in boxes of 100 or 1,000, packed in light sand, and have them examined and sealed by some professor of a reputed college or hospital. After two years the boxes would be officially opened, and the scales engraved on each instrument; then let go the competition, and success to the best.

Moreover, as there is a silent bargain in almost everything, the manufacturer could be expected to take advantage of the reputation of those who would control his instruments, and the medical institutions would receive the thermometers they need for hospital and dispensary service at cost. But any other plan will do which could secure the permanent concordance of the scale with the level of the mercury, and would be agreed upon by the physicians of this country.

So far we have considered only the mechanical improvements, and seen that they were directed on the objective of an instrument *unique* for all the purposes of human thermometry; in this race England has shown herself far ahead of all other nations. But how happened it that this *unique* instrument remained *multiple* only by the incoherence of the scales engraved upon it? France had embodied the thermic scale in her centesimal system, ten other nations had assented to the change; Austria and Russia—all but for the example of England—would have long ago embalmed Reaumur in a god-like inactivity; but the Great Stubborn for good or evil continued to use and to spread abroad her senseless Fahrenheit. Thanks to the English physicians, we see what our fathers ought to have buried—a clinical thermometer *unique* instead of many, and several discordant scales of thermometry instead of a *unique* one, whose *unity* should be founded on the thermic conditions of man. But the physicians of several countries have more than one finger in that bad pie.

This anarchy has not even the merit of being prompted by national prejudices; since the English-speaking nations uphold the scale of the German Fahrenheit, the Southern Germans, Russians, and Swedes that of the French academician Reaumur, and the French have only generalized the centesimal system of the Swede Celsius. In spite, and even because of this absurd position, we claim for human thermometry a human scale of temperature—we want a scale unique, and a multiplicity of *mètres*.

e.—Starting-point.

This proposition we support on two grounds: (*a*) *The unity of scale.*—After inventing the lactometer for the milk at the breast, the saccharometer for the sugar, the acetometer for vinegar, the alcohometer for spirits, the urinometer for the renal secretions, etc., etc., physicians must comprehend that human temperature, having its norme and its deviations, is worth having its own scale, measurer of its *calor.* (*b*). *Multiplicity of mètres.*—Sciences progress in proportion to the number, precision, and directness of operation of the instrument used to supplement the senses, and to supply the mind with data unattainable by the senses alone. This is true in astronomy, physics, chemistry, surgery; why not in medicine? . . . if for the followers of Laplace, why not for those of Sanctorius?

I said long ago: "Rien n'est plus pratique que la recherche d'une bonne théorie." Nothing is so practical as the searching for a sound theory. In consequence of such a research we come to the conclusion that medical thermometry must be founded upon the bi-basic idea of a scale human and unique, and represented by an unlimited number of pyrometric instruments. Then let the physiological scale and instruments, and the mathematical records of thermometry, answer for themselves and be judged by their *œuvres.* Their practical use will make good their theory.

III.—The Normal Scale.

The scale of human temperature has for its pivot or axis the point of normal ustion in man, or health point, from which radiate up the degrees of fever, and down those of depression. The former, but once as high as 122° F. = 50° C. = $\underline{13}$ of the Physiological scale, the latter as low as 71.6° F. = 22° C. $\overline{15}$ Ph. But for the ordinary practice the range of this Physiological scale may be advantageously limited to this

IV.—Schema of Human Temperature.

Degrees of fever (above the axis).	$\underline{7}$	Only two alleged recoveries.
	$\underline{6}$	Generally death.
	$\underline{5}$	Often fatal.
	$\underline{4}$	High fever.
	$\underline{3}$	Considerable fever.
	$\underline{2}$	Moderate fever.
	$\underline{1.5}$	Slight fever.
Axis of healthy undulations.	0	Norme, or standard of health.
Degrees of depression (below the axis).	$\overline{.5}$	Sub-normal.
	$\overline{1}$	Depression.
	$\overline{2}$	Collapse.
	$\overline{3}$–$\overline{4}$	Algid collapse.
	$\overline{4}$–$\overline{5}$	No known recovery (except in cholera and sclerema).

If this scale is truly human; if its central figure is the axis of the undulations of the vital tide and of the fluctuations of the living storms, what prevents us from writing it on our thermometer as the rule of clinical thermography? . . . . .

But men do not change their standard measures without weighty reasons. Very well. Our reasons against the old conflicting systems of thermometry are as follows:

First, we cannot be said to subvert any medical thermometry, since there are several, all disagreeing, and none established by common consent. Second, their scales, different as they are, resemble each other in having nothing particularly human. Third, the zero F. interests metals, and the zero C. salads; but when we reach either of these zeros, of what help can they be to us? The struggle for existence takes place at many remote degrees from either; we reject them because they are not human.

Our reasons for the adaptation to the clinical thermometer of the physiological scale are, that the interest in its figures is equivalent to an interest in our own health; that its scale is our biometer; that any deviation from its zero gives us a warning with a reason; and that the figures of this scale are susceptible of mathematical operations giving positive results, by

which we can calculate our own vitality, and the mathematical sum of strength we are able to spend in working or in suffering, or in enjoying (*jouissance*), as surely as we can keep our bank-account: that is not all; but such are some of the reasons which justify the creation of

V.—The Physiological Thermometer.

Fig. 75.

It differs from the others only by the starting-point of its graduation, which is zero where the centigrade marks 37°, the Fahrenheit 98.6°, the Reaumur 29.60°, the Walferdin 77°. The physiological 0 is placed in the centre of the drama, whose acts are health, sickness, and death. Who could see that and understand not? . . . .

The degrees of the physiological thermometer could have been borrowed from any previous scale; but the centigrade division was chosen because the conversion from centigrade to physiologic is made by the simple mental addition and subtraction of 37, without the trouble caused by the cumbrance of fractions; and moreover, because all the quantities having a common divisor in the French metric system, the gravity of urine, the quantity of salts, etc., the traces of the sphygmograph, myograph, spyrograph, etc., the figures or curves of the temperature, etc., are comparable and computable together in all proportions by a single operation; and moreover, because thermometry can be, by it, expressed in the positive language of mathematics.

Before following up the application of mathematical thermometry to the various departments of physic, let us not hide to view the philosophical fact, that the principle on which its calculations are founded, the *norme*, reaches higher than the bed-post.

VI.—Philosophical Value of the Norme.

It can hardly be suspected now; but let it become the central figure of our calculations in relation to the physiological soul of individuals, of nations, of the whole race, and we will soon realize by what ties our caloric binds us to the universe.

But, it may be objected, the norme in which we put so much reliance for the sick, and from which we hope so much for the provision of the future of our race, may prove erroneous?

That is true in two ways: either Becquerel, Helmholtz, F. Davy, Gavaret, P. Bert, whom we trusted did err, and their calculations in regard to the mean temperature of man, and their conclusions, would be quashed—as were those of the Julian calendar—or the thermal conditions of the race, now rightly established, would in the future undergo some alterations which would displace our mean temperature lower or higher than the present norme. If such possible alteration, ever so insensible in its march, would happen, the discrepancy between nature and the actual standard measure would soon be detected, and the new norme acknowledged as the standard measure of the next age. A series of such modifications of human temperature in the course of ages—be they progressively or alternately lower or higher than the present norme—would be simply inconvenient in quoting data from the former normes, as it is inconvenient to adjust our chronology with those of the ancients, or with the present Russian era; but, on the other hand, these series of changes would soon lay open for us the demonstration of the relation of pyretic revolutions with the entrance and exit of the so-called diseases in man, beast or vegetable; while sooner or later they would have revealed the hidden terms of the cosmic problems which have defied the successive philosophies and mythologies. Considered at a proper distance, these successive normes of human temperature would stand like the pylones of Egyptian hydrometry, instead of impediment to progress, as landmarks of the gradual modifications of the caloricity of our race and of our globe; a series of physiological monuments unequalled by any other discovery for its importance upon the *Natural History of Man and Earth.*

This is not hypothesis, but a truth which only needs more demonstration. Climates vary, not only under sidereal conditions, and according to the movements of the earth on its axis—double influence which cause each hemisphere to be in its turn warmer every 10,500 years—but also in consequence of our management of its surface. Under these climatic and other vicissitudes, the flora has changed several times; palms, arborescent ferns, and gigantic laurels have made room and soft beddings for the meek but esculent vegetables we partake of with our brute companions. Being given a perpendicular section of the earth, representing a change of axis of rotation like the one which produced Noah's deluge, these previous strata of our planet appear like the figures of an endless and everlasting thermometer, upon which we read the temperatures of past ages. The extinct fauna is no less eloquent: by the presence in the strata of certain fossils we can tell the succession of torrid and glacial periods. Man himself, though he is such a complex and perishable combination of parts, has left in his fossil, or simply preserved skeleton, or in the *débris* of his habits and surroundings, the records of his status previously to several of the last diluvia.

Cuvier acknowledges that parts of the earth once inhabited are covered with water, and other parts once oceanic are terrestrial, and our abode. We keep the tradition of the last deluge, and the earth bears the traces of fourteen of them (Lehon). As long as the present movement of the precession of the equinoxes will last, our hemisphere will be warmer by 336 hours of heat yearly than the Austral, where ice and water accumulate in the same ratio (Adhemar). But when the inverse movement will take place the glaciers will extend in our hemisphere, and already they do (Agassiz); the seas will slowly invade our low grounds; and when the boreal field of ice, 1,500 miles in diameter, softened by more heat, and left unsupported by the ocean, breaks, the fifteenth diluvium will have us. Will it seize us unaware? Can thermometry help astronomy, not to prevent such an event, at least our being carried away by it in the ignorance of cattle?

Having thus been enabled to see the prehistoric man and world, and an illimited foreboding in the distance, how easy it is now for us, by watching and registering the rate of earthly and human ustion and frigeration, to deduce from the next

gradual changes of organic and inorganic (so-called) temperatures the modifications towards which tend our planet, its flora and fauna, ourselves included.

Such results, far from being a diversion of human thermometry from its proper course, would be accounted its chief honor and crowning, as connecting the study of the present man in health and disease with his remotest links in the past and in the future.

It is not the smallest reward of the worker to see that his labor—as humble as it can be—is in constant communication with the current of the cotemporary generalizations; to feel this connection is the purest volupty; and to alternately apply the idea born or engrafted unto one's self to the solution of the lowest or highest problems, makes one comprehend that he is akin to the two extremes of the infinite.

With this elasticity of mind we find it equally easy to apply thermometry to the course of human destiny and to the fluctuations of the meanest individual ailments.

VII.—Application of the Physiological Thermometer.

After having selected the instrument, let us inquire where and how to apply it.

a.—The *lieu d'election* is quite important, as the central temperature—the only one in view here—is not equally distributed all over the body, and does not equally radiate from all its parts, in all circumstances. Its highest point is in the right heart, or sooner in the vena cava, in its passage from the liver to the heart. As those parts are inaccessible in the living man, we take the temperature nearer the surface, in natural or artificial cavities, as little inferior as possible to the absolutely central—for instance in the axilla, mouth, rectum, vagina, bladder; some put the instrument in the folds of the neck, arm, or groin; and others in the shut-hand, between the toes, etc. These selections are not all justifiable. What of the morals of those who will not put or keep a thermometer in the axilla? . . . . . Molière points and names them somewhere. Yet its frequent introduction in the rectum or vagina of young children may blunt a feeling which ought to be respected. On the other hand, the axilla is easily cooled by throwing the arms out; an

involuntary movement in some paroxysms of the adults, and in simple uneasiness of children; whilst in the aged the parchedness of the skin all over necessitates the application of the thermometer in points of contact with the mucous membrane. When this mucous membrane is the rectale, the difference with the axilla is hardly of a half degree C., as could be seen by a chart of Sutil, drawn purposely to settle this difference, and which gives besides two good warnings. (See page 149.)

Let us note two irregularities in the parallelism of the course of the rectal and axillary temperatures, and point to their cause. In the tenth day the rectal temperature is lower than the axillary, which is accounted for by a cold enema injected fifteen minutes before taking the observation; the other is an elevation of both axillary and rectal temperature the twelfth day—accompanied with a *poussée* of the pulse—in consequence of the visit of some relatives; an occurrence too frequent to be overlooked. Almost the same remark obtains when we place the thermometer in the mouth, besides the chances of its being cooled by the introduction of air through the lips, oftener from the nostrils. Consequently one may keep his mind at rest on this point, on which too much of fuss has been made. Except in particular circumstances, and for special purposes, let us select the axilla, on the authority of and in conformity to the practice of Becquerel, Gavaret, Roger, Bourneville, Will. Squire, See, etc. This question of the *lieu d'election* once settled, we will explain the *manœuvre* of the thermometer as it ought to take place at the axilla; and we will give it in the terse language used in 1866 by Dr. E. C. Seguin, in the first account of the application of a thermometer in the New York Hospital.

b. Manual of the thermometer.—"The bulb is to be inserted in the axilla, previously dried, if moist from perspiration, just beneath the fold of the pectoralis major muscle, not too deeply, the forearm of that side carried across the chest, and the elbow secured by an assistant, or by the patient's other hand. It is left *in situ*, carefully isolated from all clothing, and in perfect contact with the skin, for eight or ten minutes, being looked at three or four times, the last two determining whether the column of mercury has ceased to rise; the degree (and fractions) is then read off and registered on a blank diagram.

"While waiting, the physician has time to count and record the pulse and respiration, and even to proceed with many other points of investigation. If the time be precious, the bulb may previously be heated, about to the expected heat, and then inserted, when three or five minutes will be enough for a correct estimate."

In the wards of large hospitals, method alone can shorten this labor. To each patient the same instrument; all applied before the visit by assistants, nurses, etc., correcting their position, and noting the results, which the doctor soon controls himself; if he sees any difference, more time is given to repair the error.

When taking observations we note carefully the number of the instrument, the hour, the day, the month, and the disease; avoid taking it just after a copious stool, a vomiting, a hæmorrhage, a meal, or an abundance of heating or cooling drink, or during profuse perspiration. It is not always necessary to note the temperature of the surrounding air, unless excessive; the same of barometric pressure.

Generally it is enough to *take the temperature* twice a day, from 7 to 9 A.M., time of the lowest temperature; and from 4 to 6 P.M., time of the highest, unless these daily remissions and exacerbations are displaced.

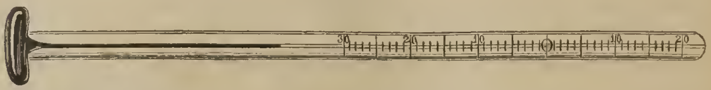
The observation is repeated oftener in important cases, in very acute diseases, in cases of doubtful diagnosis, and of deviations from the normal type; in fact, whenever anything special is noticed in the patient or occurs to affect him. Eventually these repeated observations are suitable from 3 to 4, 7 to 8, and 8 to 10 A.M., 12 to 1, 3 to 4, 6 to 7, and 10 to 11 P.M. In a rapid crisis, as in intermittent, hourly, half-hourly, or continuous, observations can alone show the progress of the case. This demands an immense amount of labor. By whom and by what means shall it be done? We will see, after completing the description of the instruments used in thermometry.

VIII.—SURFACE THERMOMETERS.

In the New York *Medical Record*, of January, 1867 (quoted by Wunderlich), I urged the necessity of inventing a thermometer for the surfaces, as we had for the cavities, and ventured

to predict that it would come out under the pressure of what I knew, and wrote as a LAW in these italicised expressions: *What mankind need, man finds:* we *needed* a surface-thermometer.

Fig. 76.



But the question was not then so clear as it now is. The first searchers, like Bouillaud, sought for some modification of the thermometer by which the same could be used *in* cavities and *on* surfaces; moreover, expecting to be able to submit to the same standard-measurement the temperature of the cavities which has a norme, and that of the surfaces which is only relative, and in a great measure dependent on the ambient, and can be figured only by comparison. Discouragement and dereliction of search were the result.

Since, when I almost pleaded the necessity of this invention before the New York Library and Journal Association, in a paper read Dec. 16, 1870, it was fortunate for me to be unaware of the discouraging opinion against the possibility of contriving a surface-thermometer already expressed by Wunderlich. If I had then known it, I should probably have given up the attempt, thus ignorance was bliss; though it is not safe to trust it, it served me in this case. Not terrified by a great man's opinion athwart my path, I saw that the instrument must be exclusively to the purpose, have nothing common, but the scale, with the cavity-thermometer, and be constructed with a view of acting on surfaces whose temperature depends on a large range of atmospheric and physiologic or pathologic combinations, almost contingencies, most of them below the *norme* of central temperatures.

In the absence of a *norme* I established one by *comparison:* from one side to another; from a well part to a similar or analogous part suspected to be sick; from a part in health to the same in a doubtful or unhealthy state, as the temporal regions, for instance (of which it is so important to keep the mean temperature as a point of comparison in children under training); from a part before, during, and after its exertions, by fixing two or more surface thermometers *on* the parts under observation.

The comparison takes place either by transferring the surface-thermometer from one place to another, or (better) by using always two or more surface-thermometers at a time. The temperature of the well side is accepted as *physiologic*, or the *relative* norme; that of the sick side as *pathologic:* the difference between the two is the *excursus* of the local fever-temperature. This is the principle of judgment in localized thermometry.

The executive conditions of success of this new instrument were, a great sensitiveness to caloric; a plan easy to set and maintain on any surface of the body; and moreover, perfectly equal divisions of its register. I think these conditions have been obtained.

(*a.*) *Modus operandi* of the surface-thermometers. Have at least two of them, self-registering or not, but perfectly alike. If their correctness becomes altered by usage or accident, make the compensation in your mind or change them.

When you want to take an observation, warm them equally about three degrees below their zero. Apply them perpendicularly, by simple apposition—pressure being reserved to test the upheaving of pulsatile tumors—to the surfaces selected, in this wise: upon a bi-lateral region, one instrument on the sick, the other on the well side; on a mono-organic region, one instrument over the suspected organ and the other over another viscera of quite similar temperature; for instance, one over the womb, the other on the epigastrium. Leave them three minutes *in situ* and read, then two minutes more, to make sure that you have attained the pathological difference between two points, whose physiological temperature (health) is alike. It is often necessary to apply, at the same time, the ordinary thermometer in the axilla, to see the amount of fever-temperature communicated to the system by the local process, or the reverse influences. For continuous observations, a belt with numerous holes of the diameter of the stem of the instruments can maintain the latter any length of time, and experiences may go on for hours or days without preoccupation or fatigue for the patient or the observer, wherever it is of interest to follow the *differences* and the *variations* of temperature, apparently caused by disease, medication, overwork, study, etc.

Wunderlich has shown how extensive is the application of the cavity-thermometer to the diagnosis, prognosis, and thera-

peusis of general diseases. It will not be here out of place to indicate some of the cases in which the surface-thermometer has been or will be as valuable a bearer of positive information.

(*b.*) *Applications.*—In local diseases of children, idiots, insane persons, and of other patients who cannot indicate the seat of their affection, the *surface-thermometer* may point it out.

In a great many feigned or dissimulated local diseases it will detect the fraud.

In the obscure beginnings of hemiplegia and paraplegia, it shows a larger evolution of heat on the threatened parts than on the sound ones, and in confirmed paralysis the reverse obtains, the temperature of the affected parts being shown lower than that of those remaining sound.

In certain affections of the brain, not otherwise appreciable, it has shown a higher temperature on one side than on the other (Brown-Sequard, E. C. Seguin).

In acute metritis and peritonitis its findings have already been a good guide to the treatment, and have proved concordant with the periods of danger and recovery. It may be equally sensitive to the local evolution of pathological heat in pneumonia, pleurisy, typhoid fever, etc., as in the slower affections, chronic meningitis, pulmonary phthisis, tabes mesenterica, chronic metritis and ovaritis, etc., etc. In articular rheumatism, sciatica, facial neuralgias, etc., it will show elevations and depressions of local temperature which may throw a new light on the origin of neuroses.

In intermittent fever it will establish the most pathognomonic sign, viz.: the exact difference of temperature in the trunk and at the several extremities during the cold and the hot stages.

In erysipelas it warns of the approaching invasion of the skin, shows the side on which it will spread, its receding or transference, and keeps a mathematical account of the relations of the local with the general fever.

With or without modification in the shape of the bulb, it will mark the changeable differences of temperature between a sick and a well eye, and may warn of the approach of the so-called sympathetic ophthalmia and of other accidents. Other specialists, besides oculists, may find it to their advantage to use

the surface thermometers, as I have known dermatologists do to their complete satisfaction.

In the formative stage of deep-seated abscesses, their centre will often betray itself by a higher temperature. In chronic and cold abscesses it will not be so, and may be the reverse.

In deep-seated surgical lesions, the new instrument will often reveal the very centre of disorganization, or the extent of effusions, of which even a skilful hand may remain in doubt; when, according to the energetic expression of John Hilton, "a surgeon finds himself between two alternatives, *plunge in the knife*, or *wait till the abscess comes nearer to the surface*, but the patient may die in the meanwhile." Then the surface thermometer will rise higher at the centre of an active tumor than in ambient tissues, and less at the centre of a passive or cold tumor than at its periphery, and will fluctuate, like the sphygmometer of Jules Herrisson, over an aneurismal tumor if the base of the bulb of the instrument is delicately flexible.

The surface-thermometer is precious to follow the rise and fall of temperature in regions lately submited to grave operations, and in the vicinity of those hidden from view by an immovable apparatus. Here is the place for the remark that the mode of observation instituted by this (and the following) instrument is kind, and never presents the grave dangers to be feared from deep palpations, percussion, succussion, and other savant manipulations, too often accused of being repeated more for the advantage of the students than for that of the patient. In any case, the surface-thermometer will have also over the hand —even the hand gifted with the *tactus eruditus*—the advantage of being readily brought to a mean, known, and unprejudiced temperature. The surface-thermometer is already employed by eminent physicians, surgeons, physiologists, chemists, etc., and is no more omitted in the classical treatises of diagnosis.

However, in the course of practice and of experimentations, I became convinced that the surface-thermometer and the physiological-thermometer, though excellent *mètres* of human ustion, did not show plainly enough the small temperature-changes, and failed to demonstrate *the rate of velocity of the escape of the body-heat*. This rate or ratio of radiation, being as important a factor in disease as the *quantity* of *combustion* at a given time measurable with thermometers, I felt

that we needed an instrument which could *show* the body-heat in the *act* of escaping (radiation) under the most delicate conditions. This idea became in the beginning of 1875

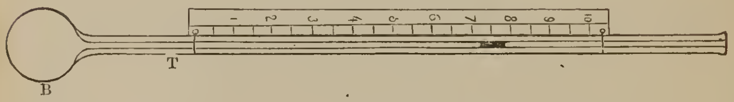
IX.—The Clinical Thermoscope,

An instrument of diagnosis in physic and surgery, a monitor in the nursery, a test in the physiological laboratory, also a necrometer in the dead-chamber.

This little instrument is a simple application to medical diagnosis of the principle of physics on which Rumford and Leslie constructed their differential thermometer.

Fig. 77.

THERMOSCOPE—HALF SIZE.



The clinical thermoscope is a glass tube T, a quarter of a line bore, seven inches long, closed at one end by a bulb, B, nine lines in diameter, and open at the other end, mouth-like, M, by a delicate enlargement of the rod. In this state it contains nothing but air. (Several other forms have been tried, more fitting to the surfaces of the body; but none favors the movement of dilatation of air like the spheroid.)

a. Manœuvre.—To make the thermoscope ready for clinical use, its bulb is heated over a lamp or fire, sooner in a bowl of hot water, and when the air contained in the bulb is dilated a few degrees above the ambient temperature, the open end is quickly plunged in—an inch deep—and quickly withdrawn from another bowl of cold water. The drop or two, which will have then entered the mouth, is seen to run up the tube. If it stops near the bulb, it will be the *index* of the thermoscope. If it stops sooner, say two or three inches from the mouth, or if it runs into the bulb, the latter was too cold or too hot; we have to jerk away that drop of water and recommence; three or four trials to obtain a good water-index take hardly a minute.

In this condition, the air contained behind the water-index

makes itself isothermal to the ambient temperature, and the thermoscope is ready.

Simpler yet: Over-heat the bulb, let the water run in it. When you want an index, invert the instrument, apply your hand on top; some water will descend in the tube and form an index; then quick, fit your scale to it, look at your watch, all is ready.

But in summer the air in the bulb, becoming isothermal to the ambient, is not dilated by contact with human *calor*, the three being almost alike. Then, previously to using the thermoscope, plunge its bulb in water at 60 or so, and after a short time proceed as above directed.

It is applied—I do not say introduced—like the cavity-thermometer—anywhere an anomaly of caloricity is known or suspected. Its habitual place (*lieu d'election*) is not, however, the axilla; it is the shut-hand.

In ten to fifteen seconds the index has attained the maximum height, or fall, of any significance.

To read it, we mark the starting-point of the index, the terminus of its course, and the time (in second) to reach it.

To take more mathematical observations, a mobile scale is attached to the stem, and made to slide, in order to put its lowest figure on a level with the head of the water-index; so that a thermoscope is always correct—that is more than can be said of most of our clinical thermometers.

But with or without a scale, it gives, by contact, indications, (*a*) at the start of the volume of heat escaping by radiation, (*b*) at the end of its course, of the *portée* or reach of its velocity; whilst, without contact, by gently blowing on the bulb, it shows the degree of combustion which takes place in the lungs, and other phenomena of ustion which I have no place to explain.

b. Applications.—Without a scale a mother can tell at what hour the index rose quicker and higher, or quicker only, and not so high, etc. Without a scale, too, a physician who well knows his case, and is short of time, can, in less than ten seconds, decide upon the dynamic conditions of the next twelve or twenty-four hours dependent on the waste of caloricity by radiation—that is to say, of life itself in many cases—and prescribe accordingly.

The thermoscope may often be called to decide about the

precise seat of an affection indicated only by general, reflex, and regional symptoms. For a few days a business man felt dispirited, good for nothing; no hunger, no thirst, no true sleep; complains of cephalalgy, nausea, hypogastric pains. The fifth day he remains in bed, has several shivers; seen in the evening, appearance prostrate, pulse 85, temperature one centigrade degree above the norme. The family was whispering fears of typhoid fever; but this rise only to 100.4° F. could hardly be found the second evening of the abdominal typhus, but the fifth! . . . Manual examination discovered nothing; the thermoscope revealed no difference of radiation between the right and left iliac regions, but proved a decided rise (half an inch) on the right of and above the pubis. This indication was trusted; warm fomentations *in situ* of a decoction of digitalis leaves and elder blossoms, warm drinks, and five grains Dover powder, brought on an abundant diuresis and a profound sleep, followed by an early start for business. What an opening for medication, if the thermometer had not told what the disease was not, and if a delicate thermoscopy had not limited the sick organ in the painful region.

Besides this daily use, the thermoscope criticises and comments some of the rare enigmatic findings of the clinical thermometer. Called near a man fallen from a three-story hatchway, I found a compound fracture of one leg, and a fracture of the skull; rather insensible to pain, full connaissance, jactitation with a speck of erotism, pulse confuse, temperature, 98.5° F.; in other terms, at the point of perfect health. Was it derision or delusion? Neither; it was a compound temperature whose component elements escaped the fever thermometer.

I tried the thermoscope; put in the hand, it rose; in the axilla, it rose more; below the sternum, it rose less; in the inner angle of the eye, it fell rapidly. The thermoscope had discovered the point where extravasated blood was coagulating—at the base. Thus became comprehensible that sardonic 98.5° F. = perfect health, in a dying man, as a compound temperature whose composition could be schematically approximated by these figures: 100.3° F. of general pyrexia, balanced by 96.7° F. of hemorrhagic apyrexia, leaves 98.5° F. This thermoscopic analysis saved the man further painful manipulations, and he died, as predicted, inside of three hours.

If we pass from the sick-chamber to the death-slab, the ther-

moscope will prove to be yet the only *necrometer* founded upon the radiation of vital temperature, notwithstanding the joke practised on the Paris Academy of Medicine, to which *my* physiological thermometer was presented as a necrometer, after displacing the zero from the point of health to a fanciful point of death.

To test the microscopic power of my new instrument, I repaired to the Bellevue Hospital of this city. By the courtesy of Dr. E. Janeway, I was shown, in the dead-house, about noon, the body of a young woman brought in at 9 A.M. The thermoscope being applied below the sternum, its index did not move from the position it had taken in the ambient temperature of a very cold January day; but put in the axilla, it slowly and steadily rose about 6 centimetres = 2 inches. A thermometer inserted instead, and kept in the same axilla fully ten minutes, did not perceptibly move.

So the thermoscope, in contact with the living, shows the activity of their caloricity; and, in contact with the dead, it ceases to indicate heat only when and where organic combustion becomes progressively extinct.

As thousands are and have been buried alive, the invention of a true necrometer excites a deep interest, intensified, if possible, since cremation is mooted. For some have knocked at their coffin and re-entered the world. But of what use would it be to knock for help inside of the furnace? The proof of death is wanted now more than ever, and, if I am not mistaken, the thermoscope will give it.

I present this simple and costless instrument to my confrères, as I did give, seven years ago, the *Surface* and the *Physiological Thermometers*, begging them to try it in the spirit of candor which made Biot say: "We must not shun the humblest contrivances, when they can improve or supplement our *medical senses*."

c. Calorimeter.—An evidence that man thinks not alone, but in synchronism with his fellow-men, is the fact that when I was making my thermoscope—which I called first, from its main function, a *radiometer*—Winternitz was contriving in Vienna his *calorimeter*, whose object was, like mine, to have an instrument with which to measure the *cutaneous radiation of heat* His is a double, square wooden box, containing the bulb of a thermometer, whose graduated stem projects outside. It is

applied to almost all the surfaces, and the heat radiated and enclosed therein is indicated on the scale.

But this invention of Winternitz, no more than mine, nor those of other searchers unknown though prospecting on the same track, do not blind me to the fact that clinical thermometry, and other parts of the medical clinic, are yet quite deficient in instruments of observation. We can smile at the last generation, arming itself to diagnose fever with bladders of Japanese variety, and pincers and saws whose teeth rivalled those of the ophidians and the placoids; in their turn, our children will laugh at our penury of instruments of *medical* observation, and wonder how we could have done our duty without a physician's (not a surgeon's) pocket-case replete with the instruments of physical and positive diagnosis, etc.

CHAPTER III.

CONDITIONS OF SUCCESS IN THERMOMETRY.

But the best instruments have a value only subordinate to the capacity of those who handle them, and to the force of cohesion of the method which binds their data in a conceps. In other words, the workman is more important than the tool, and the method more than the man. We will proceed in this natural order.

I.—Thermometricians.

If one or two observations are needed daily, the physician must take them; and if he has no time he must not undertake the case. If more are needed, he must have taught his assistants to do it, and be able to criticise the results. For his rôle is not only to take observations, but to superintend, control, and rightly interpret them. Happily, as astronomic observations are often better recorded by honest, attentive assistants, than by astronomers, so a medical student, a nurse, a relative, can be made a useful assistant to the medical thermometrician.

a.—Hospital Assistants.

There is no part of the work of a physician for which he needs so much help as for the thermometry and thermography of his cases; but he must create his helpers. He will have them in the hospital if he inspires his pupils and his nurses with the proper spirit, and bind them in the unity of object which must be the aim of the chief, for, without an ideal, patients may be well treated, but physic is ill-treated. S——, by no means a small practitioner, had once in the *Hôpital des Enfants, rue de Sèvres*, the finest staff ever gathered: Becquerel,

Roger, Contour, Jules Seguin, Rilliet, Barthez, and he produced nothing; but Wunderlich made a much more ordinary staff the instrument of numberless calculations, from which he deduced laws. The strength of the staff depending so much on the hand which handles it, I will not insist upon the individual capacities desirable in hospital assistants, only refer to what I have said in a preceding chapter on the *training of the hand-thermometer*, and in 1872, before the American Medical Association, on the necessity of *educating the medical senses* (see *Transactions*, etc., vol. xxiv., p. 187, etc.). What I have said in these, and in other preceding circumstances, is applicable also to the assistants which the physician must form himself, if he wants them in *his* families.

b.—Family Assistants.

It is when called in a family for a sick child that the physician feels the more the want of clinical assistants. If he has not taught the mother the skilled duties of nursing, and particularly the art of taking and recording the temperature *from the first moment of illness*, the life of the child is as much in jeopardy as his own reputation, and the woman not educated to assist him counteracts his management by the clandestine practices of thaumaturgy, quackery, etc., etc.: in Ephesus, Diana neglected turns Hecate. But when she has been taught the signs of disease, and particularly those furnished by thermometry, she has always taken the first abnormal temperature, and when the physician calls, she shows him a series from whose progression he can tell—if not at once what the disease is—what it will not be, and how she must continue the observation in his absence: thus an understanding is arrived at, at once. But this understanding is rather a wish than a fact?

The fact is, the absence of record of temperature *ab initio* has been the principal obstacle to the progress of thermometry, *in the hospitals* where the cases are admitted after several days of sickness, and *in the families* where none is taught to do his duty.

Since hospital clinicians cannot get at these much needed initial temperatures, who will? We must have them; who can give them? . . . Let us see.

The family physician, too, seeing very few of his patients at

the very beginning of their disease, is unable to take their first temperature: and, having everything to do himself, can seldom take it, later in the treatment, more than once or twice a day, and almost never at the critical hours, when its variations may be expected, and when they acquire the significance of premonitions.

But why is the family physician alone; and does he pretend to do everything himself, everywhere he goes? Cannot he find some help? How seldom is devotion wanted and not found, particularly at the bed-side! If the family physician had looked around, would he not have seen the overworked mother or nurse, who would be but too happy to learn how to help him, by doing intelligently what she always did instinctively before?

The family physician who complains of being unable to take his share in the progressive labors of his time by want of a clinical assistant, is simply the one who deprives of the knowledge necessary to accomplish that function the best of all the assistants, the mother. But whatever could be the cause of this grievous injustice, it first brings its bitter fruits upon himself, who, unable to thoroughly record the results of his private experience, is incapable of producing these monographs wrought to perfection now only by the Messoniers of the medical art. Deprived of the means of doing this—his share in the medical labors of his times—he sinks as much as raises his hospital confrère, whose fame grows from his own labor, swelled to an untold extent by the observations of his clinical assistants; and soon the worthy but lonely man will distrust his own experience (of which he has no authentic records), and submit to opinions, written or oracular, often less valuable than his own.

As for the woman, she is not confined to the drudgeries of the sick-room without feeling our want of appreciation of her worth in this, her special field of labor; and what knowledge her legitimate teacher, the practitioner of physic, does not care to impart to her, she receives distorted from the quack, the supernaturalist, and the theologaster.

And now let us see the results of our neglect of educating woman in the parts of our art which she can understand, in which she can help us fully as much as we can help her, and particularly in the application of the thermometer to the dis-

crimination of illness from health, to the determination of the stages, or critical periods of sickness, and to the perception of the impressions produced on human temperatures by any given medication. Here are some of them.

I would sooner pass by the teachings of the medical charlatans with the simple remark, that it is our own silence which beckoned them to speak in our stead.

c. *Deceived Women.*—Though woman never received her due technical education in medicine, hygiene, and nursing at large, yet in all times she heard muttered some mysterious words about religious powers ruling these matters. It was Esculapius, Apollo, Chyron, Lucine, etc., till these worthies being unable through discredit—see Oribasus' letter to Julianus—to pay expenses at Delphi, Epidaurus, Ephesus, etc., they were superseded by other supernatural powers. So that when the modern woman has some friends in pain or distress, she raises her supplicating hand towards Olympus no more, but to the worthies who received their diplomas from the Vatican.

For herself, as soon as the modern *uneducated woman* begins to feel the first quickening of her child, equally ignorant, alarmed, and delighted, but knowing that social conventionalities do not permit her to reveal the blessed secret, she feels too that she must appeal to somebody who knows, and who could not betray her trust. It is then, among the complex anxieties of the mind and of the womb, or, later, during the superhuman efforts at delivery, that she devotes her expected baby to the Virgin Mary, or to some minor saint, to preserve it from ill or malefice, or to endow it with health, talent, beauty, etc. Later, to cure her infant, she would burn candles at some altar; and to save him from the danger of an epidemic, she would have expensive masses expressly officiated: whilst against the eventuality of general, hereditary, or chronic affections, she had, from the first, hung to his neck an amulet on which the anagram of a gang of conspirators has been printed, instead of the image of Hercules. So much for *progress.* Anyhow, that is all these women have been stealthily taught, know, believe, and practise to manage diseases and to prevent constitutional affections from invading their families. For this, who is to blame—the Bonze who played doctor, or the doctor who did nothing?

d. *Wrongly Educated Women.*—What is, on the other hand,

the mental position of the *women, thoroughly educated in all other matters, but left ignorant in this?* Seeing everything around them submitted to certain laws of physic, mathematics, chemistry, etc., they wonder how it happens that they alone, in their profession of breeders of men, are left without rule or precept to abide by, and no possibility of acting in an emergency with any likelihood of obtaining an accurate result? They know that everything is made, cut, ornamented, or fitted according to certain rules of mechanics or geometry, as soon as men find out that it will save them time and give more satisfactory products; and, reflecting upon their own present status in the field of labor, upon the incommensurable value of the products of their loins and vigils, and upon the ignorance in which they are left of the scientific and positive part of their function, women cannot suppress their terror or disgust at being obliged to raise our children without having been taught how to do it. And I have no doubt that this is one of the reasons, and not the least, why too many of these women escape maternity, even at the risk of their own shame and death, sooner than to undertake what they know nothing about. No crime brings more surely its own punishment, dishonor, crippleness, and that peculiar sadness which imprints itself like a judgment on the once loveliest features. Who would say that women alone deserve reprobation for this, and that those are exempt of blame who could have taught them their duty and have not?

For myself I do believe, and I labor to make others believe that it is our duty to teach women—at least those who trust us as medical advisers—in the parts of our practical knowledge which they can understand, and need so much; and most particularly in the art of taking and recording the temperature of their children.

e. How to teach thermometry to mothers, and to others having charge of children.—This teaching of family thermometry is more easy than it seems; for it is not dogmatic, but occasional. Circumstances will call for the use of the instrument, and its use introduces our explanations; so each need of the thermometer is turned into a lesson of thermometry. For instance, we take advantage of the high temperature of the newborn, to compare infantile temperatures to the virile NORME. Later we have occasions to compare said NORME to the deviations

from it which characterize dentition, overgrowth, ill-feeding, eruptive fevers, excessive studies, etc. But let us always start from the NORME, and constantly repair to this New World of which Becquerel was the Columbus. Let the mother comprehend it as the pivot of health, whence radiates consuming fever and algid collapse, and she will be equal to any emergencies. This once well understood, let us not be hasty, but bide our time. Circumstances and the eagerness of the mother will draft the sequel of the curriculum of her thermometric studies, and she will soon have learned of it more than we have taught. We want a clinical assistant; here she is. She wants to know her motherly duties in the hours of peril: here is family thermometry.

In my estimation, this part of human thermometry, which belongs mostly to women, is like a ripe fruit, ready for assimilation by the minds which need it. It will emancipate women from prejudices and from superstitious practices for which the animals of the fields and of the main would despise our kind, if they knew. . . . It will place the physician nearer to the other students of physical sciences, and be a great and good step towards the triumph of positivism over supernaturalism.

If any one could think that I am a lone enthusiast on the subject of family thermometry and its annexes, let me quote the opinion of M. Littré, to which I have already alluded: "I am entirely of your opinion in regard to the services which human thermometry must render in the families, in the schools, and in society at large. Your indications are excellent, and we must not cease to preach them till they have penetrated throughout the public mind." (Correspondence, 13th Sept., 1872.)

In this respect I am inclined to think that few of us do our duty. We dogmatically prescribe or order, and do not educate our nurses and mothers to appreciate how true to nature the practice of the present day has become; and how attractive and dramatic it is to follow the parallelism of nature and art evolutions, even for those who do not command them.

It is so easy to interest these people in their hard and often repulsive labors; they would be delighted if they could see, in an improved temperature, the result of their steady nursing, and soon they would, by their effectiveness, number, experience and enthusiasm, drive away from the sick-chambers the bats of charlatanism, and we should have in them no mean helps and allies against the base theurgism now rampart. This reform

implies the abandonment of the traditional forms of doctoral authority. A true physician loses nothing by speaking like a man to his fellow women and men: honoring his subordinates in function, he encourages them, and honors himself: of all workingmen, he must remember that, *if there is ranks during labor, there is none in humanity.*

Gifted with this moral sense—which does not exclude a will—the physician is sure to find true assistants when he wants them.

f. Daily medical records.—With their assistance the physician must begin at the base, and the base of all thermic operations is the daily record thereof. It is said that *hospitaliers* keep these records; but how incomplete, if we judge by the quotations from Hospital Reports met with in books and periodicals. If Roger's staff had been impressed by and imposed that basic duty, his otherwise precious observations would not have brought him more criticisms than compliments; and himself would likely have discovered these pathological laws which he only pre-scented. One thing it is to accumulate materials, another to melt them by a fulgent flash of thought in a new idea. The word *Patience is Genius* ought to be written: patience prepares the materials for genius. Few can accomplish this double operation, usually completed when the toils of the many are resumed in one man's brain. That is, at least, the process by which a physician deduces his prognostications in each case from the daily records of his hospital and family assistants, and is thereby enabled, after a long practice, to formulate one of those simple sentences, strong with the strength of numbers, which once in a while dazzle as an unexpected truth.

That is what I had in view when I issued successively six editions of my *Prescription and Clinic Record* (W. Wood & Co., publishers, N. Y.). There must be some good in it, since it was counterfeited in Philadelphia and in Cincinnati, without acknowledgment. Oh! for human feeble-mindedness, which expects a book-lifter to call himself a thief. If that *Clinical Record* had no value in it, it would not have been stolen.

Seriously, whatever be its imperfections, it has already rendered services in the office to the physician, and at the bed-side to the mother. In its simplest form it contains only these few blanks: date, name, age, disease, to fill but once; and pulse, respiration, and temperatures, daily, or several times a day. When

the attendant is intelligent, more questions are made in regard to several functions, morbid, or morbidly affected; and another series, which the physician alone can answer, in regard to the analysis of secretions, etc. Indeed, the daily record of functions, be it in register-form for hospital, or of pocket-book size for visiting or home, is the basis of the natural history of diseases; observations written without it may advantageously be read like pathological romances.

Thus the object of a daily record is twofold: (*a*) To the mother, or person having charge of sick or young people, it shows the movement of the vital functions, with the progression towards better or worse. It enables them to give the physician a mathematical instead of a guessing account. It gives the nurse her legitimate share of the work, and of the honor due to success as well. It identifies the nurse with the physician, by giving them both a common aim, which do not allow the former to get astray. (*b*) It keeps the physician well-informed, like seeing what he could not have looked at. It shows him at a glance what he has done, what to do, and *how does* every one of his patients. It serves to record the phenomena on the spot, and the details of the treatment *en suite*, in order to keep their parallel series in view. It substitutes more and more positivism for conjecture in diagnosis and prognosis. It helps to treat complex or protracted cases with scientific unity of plan. It enables a physician to continue with perfect knowledge the treatment of the case of a confrère absent or sick, and *vice versâ*. It furnishes the elements of comparison of the medical constitutions. It lays the foundations of reliable statistics, and of true monographs, offsprings of thermography.

I do not say that my *Prescription and Clinic Record* fulfils all these indications—though I feel somewhat paternal about it. I acknowledge its imperfections, which can be corrected, after perusal, by the criticism of the profession at large; but, whatever form may be adopted, we are under the necessity of concerting some plan of recording our cases in a readable and comparable form, in order to find out the law—if there is a *law* —of the symptoms, periods, duration, recovery, or death, after the manner taught by Hippocrates, Sydenham, Andral, Wunderlich, etc. Of this work—demanded by the wants of that positivism which rules all the human and scientific affairs of our time—no true physician is too great, none too small, to

keep himself aloof. We must not forget, moreover, that the Daily Medical Record is the cradle of

§ II.—Thermography.

It has for object to describe the course of human temperature in a durable and comprehensible form, the plans of recording which are yet as unsettled as the choice of thermometers.

If the thermograph of Marey had become popular, we should use the word thermography in the same sense as sphygmography, myography, dynamography, etc., meaning an automatic representation of organic operations obtained from self-registering instruments. With it we would have been enabled to take continuous observations of temperature; without it we can observe the evolution of heat only at stated times, and our thermography consists in figuring or spotting these unconnected temperatures, which we later connect in various ways.

These records may be reduced to two systems, one by lines, the other by figures, giving a graphic and a mathematic thermography. (Of the varieties of both we will say as little as possible.)

In the graphic system we connect *the points truly observed* and *spotted* with traces, called *curves*, likely because they are rectilinear, which cannot represent the true movement of the temperature, but fill up the gaps between the hours of observation; so that, in a graphic, the isolated points are true, the connecting lines are fictitious: this noted, let us proceed.

These *curves* represent the relations among themselves of the successively noted temperatures, but they do not give any clue as to their degrees, which have to be read from the scale of a weather-thermometer appended at a side of the chart.

a.—Of simple graphic of temperature, the diagrams of the various intermittent fevers (pages 202, 203) are good specimens. When the graphic is intended to also represent the movements of the pulse and respiration, two other scales are added to the one of temperature, and the movements of the three great vital functions are figured by traces, either colored if made by hand, or in chromos, or simply black in ordinary print. In the latter, which is the more customary and the less expensive, the three traces (of temperature, pulse and respiration) may be run alone, each on separate and superposed plans, like those found in the New York Hospital Reports:

GRAPHIC RECORD OF VITAL SIGNS.

DATE, NAME, DISEASE,

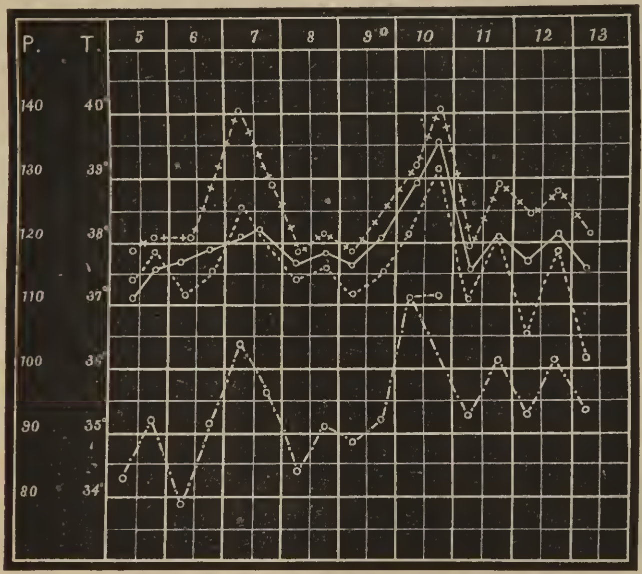
REMARKS.

	DAYS OF DISEASE.														
		ME	ME	ME	ME	ME	ME	ME	ME	ME	ME	ME	ME	ME	ME
TEMPERATURE. (FAHRENHEIT'S SCALE.)	110°														
	109°														
	108°														
	107°														
	106°														
	105°														
	104°														
	103°														
	102°														
	101°														
	100°														
	99°														
	98°														
	97°														
	96°														
	95°														
PULSE-BEATS PER MINUTE.	150														
	140														
	130														
	120														
	110														
	100														
	90														
	80														
	70														
	60														
RESPIRATIONS PER MINUTE.	50														
	45														
	40														
	35														
	30														
	25														
	20														
	15														

b.—Or the graphic may represent the three great functions on the same plan by distinct conventional colors or signs. This led to the idea of representing also on the same plan the results of anomalies of other functions, as the dechets, or the increase of body weight, growth, secretions, excretions; each anomaly is thus allotted its symbol, which runs according to a special scale, as we have given it in the diagram of a case of erysipelas by Molé, and as can be seen by the following beautiful type of:

Fig. 78.

PUERPERAL HEMORRHAGE (LORAIN'S).



It must be acknowledged, however, that not only these signs are arbitrary and limitedly accepted, but that the same author has altered his own in the course of his publications. The only chance to see these symbols accepted by the profession, particularly for clinic and class demonstrations, is to bring them to a uniformity which will insure a consensus. In this hope we will give three of the keys, out of which a valuable one could easily be devised and agreed upon.

Fig. 79.

MOLÉ'S KEY OF SIGNS.

Pulse.
Temperature.
Quantity of urine.
Density of urine.
Coloring matter of urine.
Chlore of urine.
Urea of urine.
Points of change in the direction of traces.
Crossings of traces.

Fig. 80.

LORAIN'S KEY OF SIGNS.

Pulses.
Temperature in vagina or rectum.
Temperature in the mouth.
Temperature in the axilla.
Temperature in the hand.
Chlores.
Quantity of urine.
Curving point of a trace.
Crossing points of traces.

Fig. 81.

SEGUIN'S KEY OF SIGNS.

Temperature in the axilla, T.
" in the rectum, same symbol with T. R.
" in the vagina, same symbol with T. V.
" in the hand with T. H., mouth T. M., etc.

Pulse beat.

Breathing.

Weight.

Quantity of urine, Q.

Density of urine, D.

Coloring matter, C. M.

Urea, U.

Defecations (number).

Vomiting (number).

× food, / drink, \ sweating.

Crossing points of the traces.

c.—These graphic charts show at a glance the drift of the fluctuations of temperature. They are particularly adapted to class demonstration; they illustrate well the prominent points of a febrile course; and when a generalization has attained the maturity of a law, such graphic renders its acceptance by a class almost an acclamation.

We must not forget that, traced at home by a skilful and loving hand, from infancy to childhood, from youth to virility, such a chart reads like the canto of actual life.

On the other hand, a graphic speaks more to the eye than to the mind, the latter having to translate the lines in figures, in order to have them available for judgment.

d.—The graphic gives the movement, but not the mathematics of a case; unless its curves—after having been traced from the original figures—would be translated into these figures again. Then *cui bono?* . . . These successive operations take time, money, skill. Indeed, the single *tracé* of a graphic is above

the hand and patience-capacity of many clinical assistants, who moreover keenly feel the waste in drawing of their time needed otherwise. Besides, the cost of engraving these drawings do not allow the publication of one out of a valuable hundred, and we must thank our publishers, MM. Wood & Co., for their costly liberality in this respect. Lastly, the graphics are yet all graduated with the scale of one of the *weather-thermometers*, not amenable to mathematic operations; since the starting-point of their numeration is likely more foreign to the temperature of man than to that of the moon.

Whence we conclude that if the graphic charts have helped the demonstration of *thermic laws in disease*, they have kept scarce the elements from which *new laws* can be extracted, and they have (worse yet) retarded the mathematic-reading of individual cases which prepares the advent of positivism in physic.

Trying to judge of mathematical thermometry with the same impartiality, we would say: The mathematical tables of temperature were the first historical records of it, have been and are yet the most used, and the easier written and read; besides that, they remain the *ratio* of the *curve*-charts.

Their great drawback is to have been dressed without uniformity of plan, and on scales which preclude the possibility of extracting their mathematics. These defects strike any one who tries to read and compare the observations, otherwise so valuable, of John Davy, Roger, Mignot, those of Wilson Fox and W. H. Draper, the very latest (in Appendix XIII., *c*). But the adoption of the physiological scale to record physiological phenomena seems to be only a question of time—the time necessary for an idea as clear as brook-water to percolate through skulls—and will have for unavoidable corollary the adoption of a uniform plan of mathematical record of temperature, and of the other signs of disease, worth recording. This plan has not yet been applied in hospitals, but is perceptibly a favorite mode of taking observations among young physicians, and has received weighty scientific adhesions. It is carried with the *physiological* thermometer, on *mathematical* charts in which the *figures* represent the exact quantities of *radiated calor* and are *treated* like all other mathematical quantities.

e.—This mathematical treatment of *pathological quantities* consists in submitting them to all the operations by which their

ratio—relations and progressions—can be extracted. The plan is as follows: Starting from the *normes* of temperature, pulse, and respiration—if we have been allowed to take them—if not from the norme proper 98.6° F. = 37° C. = 0 Ph., we write the temperature on the chart once, generally twice, oftener in severe cases, in the order in which it was taken.

These figures, which separately had only their own significance, acquire another by their progression, and several others by their relations: (*a*) among themselves, (*b*) with the time of the day, (*c*) with the time of the medical week, (*d*) with the period of the disease, (*e*) with the complications of said disease, (*f*) with the medication, food, excretions, etc., and (*g*) with the circumstances—antecedents and prognosticable consequents—of the patient himself; so that the writing of a mathematical chart is simple enough for anybody, but its reading is an art which has to be learned: family and hospital assistants must learn it.

These charts cannot be dispensed with by those who want to study, in computable figures and fractions, the movement of temperature, not only in the course of diseases, but during the period of incubation of infections and contagions, or in the low and slow forms of chronic affections, or in old age; nor can they be neglected by the intelligent mother, who does not trust her children to latinists and theologians, without herself controlling the constitutional effects of growth, education, training, moral pressure, etc., on her thermographic charts, of which these savants ignore even the name. Lastly, these charts are the only ones which realize the idea and the ideal of De Haen: DE SUPPUTANDO CALORE CORPORIS HUMANI (*In Ratio medendi*, T. II., cap. 10).

Skeleton Table

On which the uninitiated can write records of signs till the physician comes.

No. Name. Age. Sex. Disease.								Septenary
Days of Disease.	I.	II.	III.	IV.	V.	VI.	VII.	No.
Time of Observation.	M—E	M—E	M—E	M—E	M—E	M—E	M—E	Total up.
Temperature. Fever	....	....	....	....	....	..... .	....	
Temperature. Zero Health ..	———	———	———	———	———	———	———	
Temperature. Depression....	....	....	....	....	....	....	....	Tot. down
Daily average.......	....	....	....	....	....	....	....	Average of temperat.
Daily difference. ...	.. ...	....	....	... ...	...	....	....	Average of differences.
Pulse..............	....	....	....	....	....	....	....	Average of pulse.
Respiration.........	....	....	....	....	....	....	....	Average of breathing.

As clinical assistants become familiar with thermography the table may be brought to its present point of completeness (see p. 297).

This chart being filled for a week—a week of disease, or septenary, commencing at the first moment of illness, irrespective of the astronomic day—every new septenary is recorded on another chart, which will be numbered Septenary No. 2, and every new septenary comes *en suite* without repetition of the headings, name, normes, etc. (These charts can be had of several dimensions.) Thus, the plan of these mathematic tables embraces the temperature, central and local, the pulse and the respiration, and the sum of all the daily figures in septenaries. To these features may be added the sphygmographic, spyrographic, or other positive traces demanded by each case, and in almost all the cases, the clinical chart of the concomitant symptoms.

Apart from the extreme simplicity of the writing and reading of these mathematic tables, there is a novel feature (very old, I mean) which recommends them to the careful practitioner, to the scholar, and to all who look beyond the mere routine of our profession toward its philosophy. It is the provision made for the record of the critical days and crises.

MATHEMATICAL RECORD OF USTION, CIRCULATION, AND RESPIRATION,

TAKEN WITH THE PHYSIOLOGICAL THERMOMETER.

No. OF INSTRUMENT. NAME. AGE. SEX. MALADY. No. OF SEPTENARY.

Date,								Maximum day....................
Day of sickness,								Minimum day....................
Barometry,								Difference.........................
								Sum of morning..................
External thermometry,								Sum of evening..................
Time of observation,	M E	M E	M E	M E	M E	M E	M E	Sums of the week................
Central temp. taken in .... Fever....................								" of fevers..................
Norme, 98.6° F.=37° C.=0.								" of normes...... ....
Depression................								" of depressions...............
Daily average............								" of averages................
Daily excursus...........								" of excursus ....
Local temp. taken on .... Sick point...............								" at sick point.......... .....
Healthy point...........								" at healthy point..............
Difference								" of difference...............
Normal pulse................sickly.								" of sickly pulse..............
Pulse, daily excursus..............								" of pulse excursus...........
Norm. respiration...........sickly.								" of sickly respiration.........
Respirat. daily excursus...........								" of resp. excursus............

CHAPTER IV.

DOCTRINE OF THE CRISES.

That is a small place offered to a very old, and once much revered host of ours, the *Doctrine of the Crises;* yet it is a larger one than modern hospitality proffers to it. We will give, besides a commanding position on the *mathematical charts*, a few pages to the exposition of its almost divine pretensions. In return for which liberality—show-word for usury—I expect we may obtain, after a few years of diligent researches, the unveiling of strange coincidences, in the results once obtained by medical theurgism, and those now arrived at by medical thermometry.

§ I.—Medical Theurgism.

When medicine was blended with theology, and therapeutics with theurgy, God was one, matter two, their union three, the universe twelve, its square root four, the perfect number,—whose union with three forms seven, which is endowed with particular virtues. Since Plato and Paul some of these figures have been somewhat altered. But then and correspondingly, Nature was medicative as well as creative. Diseases had, like all things, their proper lives and periods mathematically preordained, in virtue of numerical and biological laws; hence their crises and critical days could be foreseen, and were foretold (prognosis).

Hippocrates believed in both, but—as far as is known—wrote on the subject only practically, not theoretically. Contrarily Galen, who admitted the crises, but rejected the critical days, wrote the theory of the latter, though under protest to the gods, whom he was in the habit of using as small change.

After that period, the old dogma fared still worse, being made subservient to the practices of necromancy, mysticism,

amulet and saint-cure, etc. To make short a long story, nowadays many physicians—possibly not always the highest—are indifferent to the *crises* and sceptical as to the critical days; which is quite natural, having no means of verification commensurate with the magnitude of the problem. But dereliction is no reason; how many discoveries of Hippocrates—I call by his name him and his times—have lately been *retrouvées?* Laryngotomy, auscultation, urinoscopy, etc.; it is now time that his dogma of the crises should too be finally tested by the standard of modern analysis.

Like all discoveries, this was the product of the copulation of several ideas: the Pythagorean computations, the data furnished by the highest education of the medical senses, particularly of the *tactus eruditus* (including the hand-thermometer), and the generalization of the hospital records of a school which the pretended father of medicine declares already very old in his time. Indeed, in the temple, school, and hospital of Cos, at least fifteen generations of Asclepiades had preceded him, practised upon all sorts of diseases, temperaments, and nationalities, and registered all their cases, likely above one million; materials fully equal in number and importance to those accumulated by our indefatigable thermometricians.

This was the treasure in which Hippocrates found the elements of his doctrine; not only on crises, but on revulsion and on sympathies, out of which, by the by, it took two generations of powerful Darwins to hatch the doctrine of *Natural Selections.*

We can form an idea of the clinical notes of the ancient hospitals by those of Hippocrates. His *style* is his assuredly; since his apocrypha are recognized by the absence of this style; but his *form* is so much like a cast, that the description of his own cases seems prisoned in the routine frame of the Cos' Hospital Record.

We cannot so well form an idea of their *classification;* but they must have laid in some nosologic or other order, without which it would have been impossible to search for and extract the elements of comparison from such a dense mass of facts, and to deduce from their *ensemble* generalities like the Gnidian Sentences, the Aphorisms of the Master, and even the weaker precepts of Salerno.

Altogether the monuments demonstrate that, in private and

in public practice, records were kept and made use of, not only for the advantage of the patients, and for the advancement of medical knowledge, but for the incubation of powerful generalizations and *pathologic laws.*

It is in these conditions—which it was important to establish—that Hippocrates (and his school) asserted the dogma of the influence of numbers on the crises and cure, and referred to it as to a *law*, whose eventualities, happy or fatal, could be calculated and predicted. He presented it as a law known before him, and which he confidently used as his surest *criterium.* That it was *his criterium* is proven by the eagerness with which he seizes upon any opportunity of founding upon it his diagnosis and prognosis, of testing by it his treatment, and of introducing it in almost all his books as the fundamental principle of his teachings ; his synthetic doctrine.

In the history of medicine there is only one thing like it : it is the industry with which Wunderlich (and his helpers of every country—I name him as the embodiment of thermometry)—has evolved pathological laws out of the innumerable and intricate data furnished by the thermometer.

But what is more surprising in this similitude than the similitude itself, is the quasi-identity of their results. Wunderlich, starting from mathematical computations repeated and verified upon a magnitude only equalled, if at all, by the chief of the Coan School, arrived at conclusions which find their analogues in those deduced from the Pythagorean theories of numbers applied to the clinical treasures of antiquity. This coincidence, foreseen by Traube, hinted at by Dr. Woodman, will cause such surprise, and is so momentous for the progress of our art, that I will try to give it all the prominence it deserves, and avoiding where I can, to give the facts in my own language, I will let both Hippocrates and Wunderlich echo each other's doctrines and clinical experience, at two thousand three hundred years' distance.

§ II.—Hippocratic Doctrine and Experience of the Crises and Critical Days.

The living body is a circle without beginning or end ; an harmonious whole, whose parts are in mutual dependence, whose acts in mutual solidarity.

This law presides to the phenomena of health, as well as to those of elimination and reparation in disease.

This latter and double elaboration, fever, *febris*, ends by an even resolution, λυσις, or by a sort of revolution, κρισς, at certain days called for this reason *critical*, decretory, or judiciatory.

He—who is desirous to predict with certainty the recovery or death, and how many days a disease will continue, or in how many it will cease—must understand the whole doctrine of the *signs* and how to compare their relative importance. Since the foregoing signs are true in Lybia, and in Delos, and in Scythia, you do not require the name of any disease which has not been particularized here; for you may know by the same *signs* all those which terminate within the periods laid down above (Third Book of Prognosis).

And what are these periods?

The *crisis* is an effort of nature to produce a change (beneficial or not), and which heralds the end of a disease.

The days are divided into *critical*, *indicator*, and *intercalary*, and *non-decretory*.

The *critical*, *decretory*, or judiciary days are comprised between the fourth and eightieth; namely, the fourth, the seventh, the fourteenth, the twentieth, the twenty-seventh, the thirty-fourth, the fortieth, the sixtieth, and the eightieth.

Between each of these periods of seven or twenty days the crisis may take place, or sooner be *indicated* the next fourth day, thus: the fourth; the eleventh, which is the fourth after the seventh; the seventeenth, which is the fourth after the fourteenth, etc.; these are *indicators*, in other words, give signs of an approaching *crisis*.

The *intercalary* days, the third, the sixth, the ninth, the sixteenth, etc., give issue to imperfect, or irregular, or fatal crises.

The *non-decretory* days, the second, the eighth, the tenth, the twelfth, the thirteenth, the fifteenth, etc., were not expected to give issue to crises.

To ascertain these periods it is necessary to observe from the first day, and to remark the changes of every fourth day; and thus may the *probable* termination be predicted (Progn., Sect. 3).

Fevers come to a crisis on the same day, as to number, on

which men recover or die. For, the mildest class of fevers, and those originating with the most favorable symptoms, cease on the fourth day or earlier; and the most malignant, and those setting in with the most dangerous symptoms, prove fatal on the fourth day or earlier. Those who labor under the tetanus die in four days; if they survive this period they recover. Thus end the first class of fever.

(If in a continued fever the patient suffers most on the fourth and fifth days, and the crisis does not take place on the seventh, the case is usually fatal. Other ardent fevers (without remissions) terminate the seventh or fourteenth day).

The second class of fevers is protracted to the seventh day, the third to the fourteenth, the fifth to the seventeenth, the sixth to the twentieth. Thus these periods, from the most acute disease, ascend by four up to twenty. But none of these can be calculated by whole days, for neither the years nor the months can be numbered by whole days.

After this in the same manner, in diseases of the same character, and according to the same progression, the first period is of thirty-four days, the second of forty, the third of sixty.

In the commencement of these periods it is very difficult to determine those which will come to a crisis after a long interval; for these beginnings are very similar, but one should pay attention from the first day, and observe further at the first additional tetrad or quaternary, and then one cannot miss seeing how the disease will terminate.

Those which will come to a crisis in the shortest space of time are the easiest to be judged of, for the difference of them is greatest from the commencement.

In the same manner are the crises of puerperal diseases to be ascertained, by calculating from the labor.

In the commencement of these diseases it is difficult to ascertain *à priori* in what space of time they will come to a crisis, for they commence very much in the same manner. But it is necessary to observe carefully from the first day, and to remark the changes every fourth day; and thus may the *probable* termination be ascertained.

The course of the quartans observes the same order.

The tertian fever terminates generally in seven periods.

Acute diseases generally come to a crisis in fourteen days.

It is easier to foreknow the *crises* of diseases which are to

terminate in a short time, because, from the beginning, they differ very much.

The prognosis of diseases that are verging to a crisis is to be deduced from their duration and the manner of their *accessions.*

When fever ceases without evident signs of the disease being resolved, and on days which are not critical, you may expect a relapse.

Those in whom the pain in the head commences on the first day, suffer greatly on the fourth and fifth, and die on the seventh.

For the most part, however, the pain commences on the third day, is much distressing on the fifth, and death occurs on the ninth or eleventh day; but if the pain begins on the fifth day, and "the other symptoms come in correspondent order," the disease will terminate the fourteenth day.

Young persons die of this disease (acute meningitis and otitis) on the seventh day, or rather earlier.

Relapses in diseases are most fatal to very young persons.

These rules hold good both in men, women, and children, and apply particularly to fevers of a tertian and continuous type; by these you may predict death or recovery.

If the Father of Medicine needed any sponsors, hundreds could be found among the highest authorities of recent times, but two will suffice. Sydenham says: "However true it may be that intermittent fevers may last six months, particularly under bad management, if you calculate rightly you will find that fourteen days of twenty-four hours each make 336 hours; whilst, by allowing five hours and a half for each paroxysm of a quartan, you find in one full attack fourteen days or 336 hours." And Andral observes that "of ninety-three cases of pneumonia, twenty-three died on the seventh day, thirteen on the eleventh, eleven on the fourteenth, and nine on the twentieth. The recoveries on the critical days averaged fourteen, and in non-critical days hardly exceeded three."

§ III.—Wunderlich's Doctrine and Experience of Crises and Critical Days.

The healthy temperature of the human body, disregarding diurnal *oscillations* and the slight *variations* caused by circumstances or moral impressions, is 98.6°F.=37° C. (=0 on the physiological thermometer).

All temperatures which decidedly exceed or fall short of that norme are unhealthy, and *signs* of a diseased condition.

The typical course of temperature in many forms of disease is an undeniable fact, upon which is founded the idea that there are such things as *normal diseases.*

Certain diseases in their progress obey certain laws, or rules, which can be determined by thermometric measurement of the course of their temperature: these are the *laws of pathological thermometry.*

When thermometry thus discovers a new law of disease it reveals a *new world in the domain of natural laws.*

Disease has its laws, but we cannot yet *codify* them.

A knowledge of the course of temperature is indispensable to learn the laws presiding over the evolution of certain diseases, and the deviation from these laws; to discover the tendencies to relapse or better, to regulate the therapeutic, to ascertain the convalescence, or to reveal complications, the imminence of peril, the impossibility of the continuance of life, the proof of the reality of death.

And what are these laws?

Temperature is the regulator of life.

Thermometry is the art of measuring the deperdition of life.

In physiological temperature the heat is generated and given off in such proportions as to keep the body at zero-health.

In pathological temperatures the equilibrium-health is broken by over or under-production or emission of heat, in a proportion written up or down the norme on the physiological thermometer.

Not only must we know the laws derived from this principle of unity of life; but in our application of these laws to special cases errors are unavoidable when the initial period has not been under observation, and still more easily when no informa

tion as to the commencement of the attack can be obtained; and we are thus left in ignorance as to the time the disease has already lasted. Thus all our computations become uncertain. And more, before drawing conclusions from a single thermometric reading we must see the other symptoms, and consider if they agree or contrast with the temperature.

Under the name of *Ephemera* are included fevers which last only a few days; the length of the fever does not affect its height nor its issue. Diseases which begin with a strong pyrogenic stage have a short paroxysm, with a sharp elevation of temperature and a continuous course, ending in less than a week in defervescence or death.

Children exhibit more sudden and extensive changes of temperature than adults—more sudden *plunges* and earlier *elevations.* A temperature of 38° C. may not be a sure sign of disease, but invites renewed applications of the thermometer.

In childbed a temperature of 38° C. is suspicious; the later the fever the stronger its course, sometimes reaching 42° C. and lasting to the fourth day.

In traumatic fever the defervescence is expected the third day. The duration of pyæmic fever is a week, unless protracted by series of zigzag deviations.

The *reign of law in diseases* is manifested in typhoid fever, even through its irregularities.

The fevers may be divided into more or less clearly defined periods or stages: the pyrogenetic, the acme or fastigium, the decrement, proceeding or not by a *perturbatio critica* (lysis or catalysis) the defervescence and convalescence, or, on the contrary, the pro-agonic period.

It is noteworthy that in the majority of cases which run a regular course, the duration of the separate periods corresponds in time with the division into weeks and half weeks. The alterations in the course, and the transitions from one stage to another, occur at the beginning or end of a week, or in the very middle. This type is most decidedly shown in the brief and mild forms, and in the third and fourth weeks of the more severe ones.

Periods in typhoid fever: the *initial stage*, four days, describing zigzags, composed of diurnal elevations of 1°—1.5° C. and nightly falls almost to normal, and reaching 40° C. the

fourth day. This course is almost pathognomonic of the typhoid fever.

In the second half of the first week the morning temperature is lower by .5°–1.5° C. at the same time that the maximum is reached, 40.8° C.

The end of the first half of the fastigium most commonly falls on the seventh or eighth day.

The first half of the second week agrees in the main with the preceding period, but is marked, in cases whose course runs favorably, by less severe exacerbations. In very many severe cases there occurs, at tolerably well fixed days of the disease, either a transitory moderation, or a particular elevation of temperature. All irregularities in the second week are suspicious.

The *remission* seems to prefer the last day of the week or the middle of a week; the *elevations* come immediately before those days, or at the beginning of a fresh week.

The rise of temperature towards the end of the fastigium (seventh to fourteenth day) generally betokens complications.

We often observe a striking rise of temperature about the twenty-fifth day.

The beginning of *decided improvement* in cases of moderate severity is expected in the middle of the third week.

The regular course of typhoid fever is about twenty-one days; each relapse indicates fresh exudations and infiltrations of the intestinal glands; each better, elimination and reparation. This typical course of three weeks is not so well exhibited on the first attack as on the following ones. It is noteworthy that, in the majority of cases of typhoid fever which run a regular course, the duration of the separate periods corresponds in time with the division in weeks and half weeks.

Periods in typhus:—In moderate cases the temperature has reached its summit the fourth day, and about the sixth day is the turning-point, announced by a trifling decrease of temperature, followed by a greater remission the seventh.

Truly there is another rise about the eleventh, but it does not reach the previous maximum, and lasts only one to three days, after which the twelfth is marked by a preparatory remission. A third, but generally favorable rise, like a *perturbatio critica*, occurs, terminating in final defervescence. These simple cases terminate in two weeks.

In severe or neglected cases the continuous ascent and exacerbation continue through the first week at 40.2°—41.6° C., or more. The remission of the seventh day is absent, and the high fever persists through the whole of the second week. The remission of the twelfth day is wanting or postponed to the beginning of the third week, etc.

But this comparison must be cut short, to limit it to its strict bearings on thermometry, whereas it interests all the important points of physic which cannot be introduced here. However, I have transcribed just enough of it to show that we are confronted with the double-headed fact that:

On the one hand, the first records of our art founded on the theogony and geogony of numbers applied to a persevering observation of the signs of health and disease; and on the other hand, the latest records taken and arranged by our most accurate men, with instruments whose precision is unimpeachable, of physiological and pathological temperature, and of other vital signs as well, have both developed the identical conclusion that: THE MOST IMPORTANT DISEASES (if not all) RUN A DEFINITE COURSE, IN DISTINCT PERIODS, AND IN SO MANY DAYS, WHOSE VIRTUE RESIDES IN THEIR NUMERAL ORDER, RECKONING FROM THE FIRST OF THE DISEASE.—So said Wunderlich after Hippocrates.

I do not mean to say that none was heard on this subject between them. Previously to Wunderlich, Aymen (*Dissertation sur les climats et les crises*, Dijon, 1751) admitted that "the crises take place in the same manner, at the same days, as in the time of Hippocrates." Landré Beauvais said (in his *Semeiotique*, 1830), "The morbid phenomena may vary; but as for the crises, during a practice of more than twenty years, I have constantly observed their apparition at the very time announced by Hippocrates." Traube transplanted the doctrine from Paris to Berlin in 1840.

That doctrine of the crises was for the ancients a dogma; in the dark ages it was a symbol; for us it must become a *law*, instead of remaining the *ignis fatuus* which lights our faces with its sardonic glare.

CHAPTER V.

MATHEMATICS OF DISEASE.

MAN learns, but forgets too. This *doctrine of the numbers*, which appears to us an isolated monument whose key is lost, was one of the links of a cyclopedic chain of evidences on which rested the purest knowledge of antiquity. In that doctrine, of which the theory of the crisis appears in the distance like an Hippocratic segmentation—though Hippocrates acknowledges its antiquity—the power of numbers binds and pervades the whole. *Ideals* result from the conjunction of numbers (in our to-day's parlance " from certain combination of ideas ") into life-forms, or *realities*, which in their turn disintegra e (we say by oxidation), they said by the destructive power of new mathematical combinations.

About this discrepancy of words, and in view of others on our whole subject, it is good to remark that in judging of past doctrines we must not let ourselves be deceived by the forms of language of the ancients, nor by that of the Renaissance, nor even by our own: a deception which caused the burial, as rubbish, of some of the pearls of the fifteenth, sixteenth and seventeenth centuries.

In Greece, whose doctrines we have now in view, everything in nature was *animated*—a brook, a temple, a well, a nationality, an art, a discovery, etc. By the same operation of the polytheistic turn of mind, *numbers* were deified, particularly after the mathematical masteries of the schools of Corinthe, Syracuse, Bergam, Alexandria. But in plain *thinking*, denuded from the amiable theolatry of old times, we read, through the doctrine of the ruling power of numbers, that of the harmonies of the world—the visible face of *law in nature* —what can be seen of God.

From the bulk and course of the celestial bodies to the movements of the rotatory infusoria and fil'form bacteria;

from the normal frigeration of a planet to the norme and anomalies of our own combustion, the Whole obey the law of harmony of numbers. Democritus knew the music of the spheres; Laplace, the mathematics of the heavens; Lavoisier, Priestley, Berzelius, the creative power of numbers in chemistry: we calculate, and to a certain extent regulate, the biologic properties of human *calor*. Our language may differ from the Greek, but for us as for Hippocrates, Pythagoras, Herophyles, and Erasistrates, *a disease is a disorder of the mathematics of life*, mostly by abnormal oxidation of its atomic constituents.

Those who have followed the development by *modernization* of the Hippocratic idea, will be prepared to rise from the comprehension of the laws of the body's ustion to that of the more general law of Calor in Nature; and reciprocally, to descend from the ideal of Eternal Ustion, genitor of life and death, to the mathematics of our own temperature in health and disease—physics and physic reverberating their light at each other.

§ I.—Mathematical Relations of the Functions Alterable by Disease.

By the progress of positivism and the force of its method, the other disorders of the mathematics of life—other than hyperpyrexy and aprexy—come one after another to be gauged by the same mathematism; the sphygmograph and other inscribing instruments, and chemical, microscopic, and spectral analysis bring around the figures of thermography their concordant figures, by which is completed the halo of positive observation.

One must have noticed that the observations of temperature have been carried with such enthusiasm, that they have left in their progress—distanced behind—the other modes of observation (except possibly microscopy); and have thus comparatively and temporarily lowered the standard value of the other signs and symptoms of disease.

This exclusivism was quite natural during the crusade for the propagation of thermometry, which like all new religions was not preached by half. But now that its success is assured, it is wise to see to its legitimate spread, and to define the place it must occupy, not instead of, but among the other means of

diagnosis. Assuming its normal position, thermometry will gain in associated strength what it may have to lose in solitary grandeur.

Having only a small space, and wishing to speak with authority, I will borrow the words of the most concise of medical writers, to convey, with due force, these views on the subject of correlation of all the symptoms: "It is a bad symptom when the head, hands, and feet are cold, when the belly and sides are hot. But it is a very good symptom when the whole body is equally hot." This aphorism ranks Hippocrates among the thermometricians; but far from being an exclusive one, he instantly adds: "He who is desirous of being able to predict with certainty the recovery or death of the sick, and how many days a disease will continue, or in how many it will cease, must understand the whole doctrine of the signs, so as to be able to judge of all the symptoms, and to compare their relative importance according to the *rules*. . ." (Prognostics, p. 3). So we were forewarned against this natural tendency to exclusivism, of which Bordeu furnished an example which can well serve as a lesson. After writing his four volumes on the *Pulse*, he would go through the Charity Hospital without looking at his patients, only feeling their pulse and prescribing: astonishing the crowd of students by the acuteness of his diagnosis. Malicious chronicles do not say that he likewise refused to look at his quasi-royal patient, the Duchess de Pompadour; but grave history attests that his successors in the celebrated clinic, Laënnec and Andral, founded their famed diagnosis upon the even exercise of all their exalted medical senses.

After all, the practical point of this is contained in these few words of Hippocrates: *We must understand the whole doctrine of the signs.* The doctrine may be improved; the number of the signs may be increased, it must not be diminished, under the penalty which overtook our predecessors for their neglect of Hippocratic urinoscopy, etc. The signs furnished by thermometry are indubitably invaluable; but they cannot take the place of all the others, no more than any of the others can take theirs. Therefore let us not only study all the signs of disease, but constantly keep their relations in sight.

A.—Relations of Central to Surface Temperatures, etc. —The alterations (by disease) of the mathematical relations

of functions are nowhere more marked than between the central and the peripheric temperatures, and between symmetrical parts revealing an asymmetric ustion. I have just of the latter a case in point:—Right ankle, tan-copper colored by syphilis, T. 34° C.; left ankle indemn 29° C., as per surface thermometer; subsequent observations differed in figures owing to our autumnal variations, but remained in the same relation to each other, till treatment (which would be here out of place) restored the equilibrium. Be it noted, also, that all the while the patient complained of the coldness of the all right limb, whose ankle radiated more heat than his calorigenic function could supply. (For the generalities of this almost new branch of the subject, see Part I., Ch. IX.)

B.—RELATIONS OF THE TEMPERATURE TO THE PULSE AND BREATHING.—Theoretically, when one of the three vital functions is disordered, the others follow suite. Practically we can hardly say that such is the rule, since there are so many exceptions which become rules in their place. (See Appendices VI. and VII.) Having seen that an elevation of temperature in a part may be communicated to the all body, or leave it at its norme, or cause it to fall below, we are quite prepared to see an abnormal temperature either cause, or not, an abnormal circulation or respiration—neutral, concurrent to, or antithetic to its own course. These remarks obtain in health, and more yet in diseases, where the three functions may be related, but not always subordinated; and where their relations and reactions change, according to the sort of disease, to its actual period; to its past and expected duration, etc. . .

(*a*) *At birth* the regularity of the fœtal pulse, yielding to the influence of new stimuli, is greatly accelerated the while temperature undergoes frigeration, and when a few days later the temperature rises, the pulse becomes slower. Then disease is mostly expressed by accelerations of the breathing which have no necessary concordance with the two other vital functions. (See Appendix VI., tables *a*, *b*, *c*, *d*, *e*.)

(*b*) *In adolescents*, particularly scholars, a break of the equilibrium of the three functions by increased frequency of the pulse warns of the dangers of too rapid a growth, or of bad habits; and an elevation of temperature of .5 in the morning, 1–2 in the evening, points towards meningitis or phthisis.

(*c*) *In healthy adults*, the three functions are quite harmonious,

though there are exceptions:—a pulse at 30, 40 (25 have been counted) with respiration and ustion normal; those and others are idiosyncrasies precious to base a diagnosis. In old age the pulse takes the precedence on the two other functions, either by the quickness or hardness of its strokes.

(*d*) The *mathematics of these relations in the aged* is infinitely precious, since it permits to foresee dangers ahead. I have just seen a client (æt. 60, not actually sick) whose normes are T. .2, P. 64; and finding T. 1, P. 75, I admonished him from some perturbation, and he acknowledged having had some business excitement a few hours before. Just as the concordance of the three functions is a guaranty of health, so the disruption of their equilibrium gives a warning of danger. In the present case—be it noted by the by—the very relations of the senile normes T. .2 to P. 64 indicate a condition which cannot stand much pressure.

(*e*) During disease the restoration of the concordance of the three functions affords more security than the absolute return to its norme of only one of them. Moreover, the very mode of the anomaly of their relations is often sufficient to form the diagnosis of a disease otherwise obscure. Thus the concordance of the exaggeration of the three functions is almost pathognomonic of pneumonia; a moderation of the ustion with rapid pulse and respiration warns of bronchitis; a low and rising temperature with active pulse and breathing signalize the first four days of typhoid fever, whilst later the temperature is high and the pulse comparatively slow. But let an hemorrhage supervene, you are instantly apprised of it by the chief actors' changing rôle, the temperature becoming low, and the pulse quickening in proportion to the *épanchement* of blood, etc. A clinical lecture on peritonitis, recently delivered at the Bellevue Hospital of this city, by Prof. Loomis, of the New York University Medical College, illustrates the low condition of the temperature as compared to the pulse and respiration in affections of the serous membranes. Here, the temperature speaks by its silence, and the contrast of the two other vital signs points to the often obscure diagnosis (see Bibliography).

(*f*) If it was possible to generalize the varied relations of these three functions in disease we would say: During the effervescence the elevation of the temperature is synchronic with the

increased frequency of the pulse ; the fastigium is marked by the (relatively) greatest concordance of the three functions ; the perturbatio critica, pseudo-crisis and pseudo-defervescence are the periods of the greatest discrepancies ; the defervescence is marked by rapidity of the pulse next to sub-febrile temperatures ; and convalescence by an almost feverish ustion, the pulse becoming slower and stronger, the breathing deeper and less frequent.

Contrarily, in the issues towards dissolution, the great functions—which, from this point of view, may be called co-ordinate—become dissociated. Pulse uncountably rapid, or slowing with ominous stops, in contrast with temperature growing from sub-febrile to algide, if the disease has lasted ; if not, rising as from a pyre to consume all the reserve caloric in the last moments, and with breathing generally hurried till the final gapes, which are few and wide apart.

The mathematics of these dissociations of the co-ordinate functions constitute, after all, the sorcery of prognosis, which must guide us, not only in disease, but in the critical passages of existence, in infancy and adolescence, during the crises of puberty, of the extra-labors necessary to conquer a social rank, of new married life ; indeed, whenever a doubt hangs over the sanitary influence of our doings.

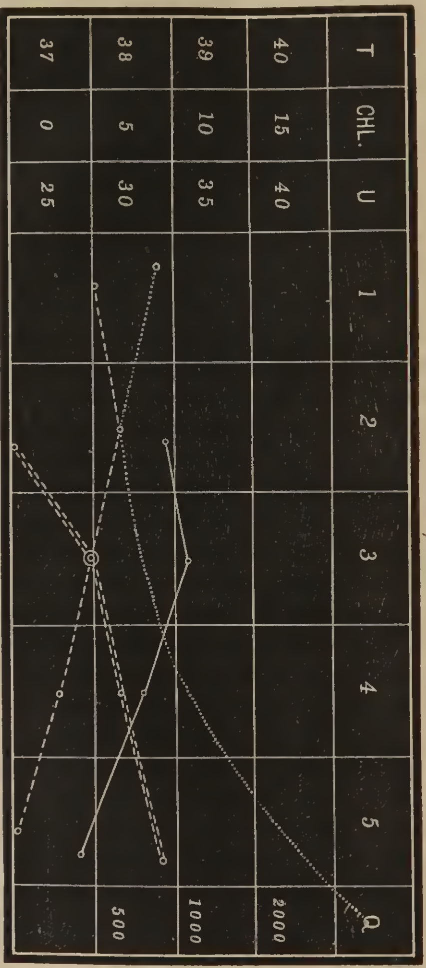
C.—Relations of the Temperature to the Urines, and their Constituents.—From the time the ancients conceived *a priori*, and admitted in principle the *depuration of the blood by the excretory apparels*, they became fascinated by urinoscopy, attached a great importance to the signs furnished by urine, and connected its successive characters with the periods of maladies. Considering that they had not our chemical reactives, microscopes, etc., one is astonished at the happiness of some of their hypotheses, particularly in regard to the *urines critiques* (those which almost invariably characterize the passage from the fastigium to the defervescence). We do not, of course, see so much as they did in urine ; but we try to see correctly.

The special diseases represented by the excess or the privation of certain elements of the urine, those caused by the retention of urea (uremia) and by the loss of albumen (albuminuria), will find their place later. Here we will only notice the *relations of urine and its components to febrile temperatures* which have been recently studied (see Bibliography).

(*a*) It was found that *in the period of effervescence*, to the increase of heat corresponds a diminution of the urine in pneu-

Fig. 82.

RELATIONS OF TEMPERATURE TO UREA, CHLORURES, ETC. (*from* BEAU).



monia and rheumatism, not in typhoid fever. Generally the reaction is acid, the coloration deepened by the presence of destroyed red globules of the blood ; the sediments abundant by excess of uric acid, paucity of water, constant augment of

organic and extractive matters: all causes of increased density. At the same time the albumen may be slight, frequent and favorable; but the urea, often excessive, always variable, sometimes absent, has no parallelism with the temperature, of which it is no test. Surer tests of pyrexia would be the augment of the extractive matters, and the almost disappearance of chlorure of sodium from the urine.

(*b*) *In the period of defervescence*, with the decrease of the temperature increased quantity of urine, lighter density, paler coloration, less or no sediment. Reaction often alkaline, constant diminution of organic matters, ordinary diminution of urea, considerable diminution of extractive matter. Considerable augment of inorganic matter, and particularly of chlorure of sodium. The urine of the *convalescent* offers the same characteristics, only more marked.

These relations of urine and its constituents to temperature can be comprehended only when thermographically written in figures or in curves. The schema of the relations of temperature, chlorures, urea, and quantity of urine in erysipelas, is almost typical of the mathematical relations which can be traced in any inflammation of short duration.

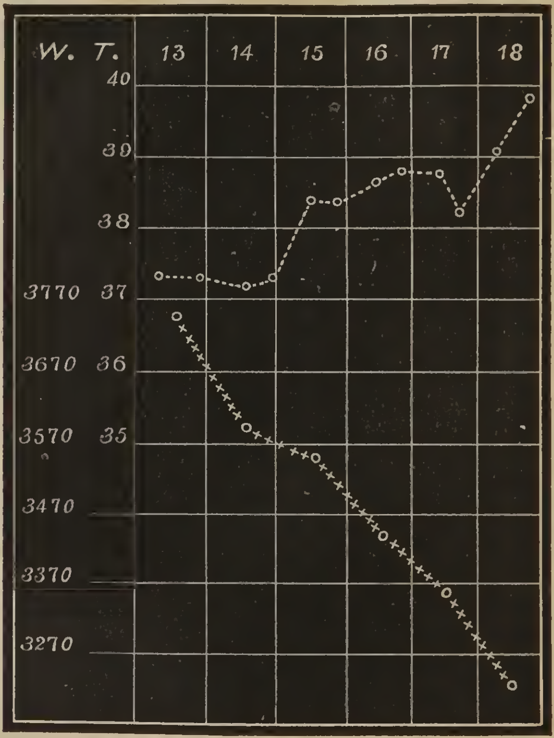
Similar observations, bearing on the relations of febrile temperature, pulse, and respiration with the sweating, saliva, and sebaceous secretions, have not come to me; though we are advertised by our senses that almost every disease, and likely every period in a disease, leaves its specific imprint, trace, color, odor, or effluvia, perceptible by our *medical senses* and comparable to and confirmatory of their thermography.

D.—Relations of Temperature and Body-weight.—From the beginning of medical thermometry, the fluctuations of the body-weight have been considered as corollary, and shown to be valuable as a commentary to the fluctuations of temperature. Yet, from the weighing-chair of Sanctorius, or from our weighing-beds, few observations have been made available. Let us except those of L. Thaon, *On the Weight in Diseases of Children* (in Archives de Physiologie, 1872, p. 674), from which we condense the following propositions: As ustion increases, the waste by combustion is represented by a loss of body-weight in the proportion of, say, grains of ashes for pounds of burned fuel, grains of urea for pounds of oxidized human-tissue.

But when the combustion of tissues has been brought to its ultimate point of endurance, the balance is reversed, and the effect of further emaciation is to reduce the temperature, even as low as 34° C.; that is the period of *consumption.*

Fig. 83.

PROPORTIONS OF BODY-WEIGHT TO TEMPERATURE.



Whence theoretically, and generally in fact, fevęr, *ferveo,* is marked by a deperdition of weight commensurate to the degree of the ustion. But practically it is sometimes otherwise, these discrepancies giving as precious indications as the broad rule. Let us read both.

The broad rule is: (*a*) *In fevers the body-weight decreases in the same ratio as the temperature increases.*

The special rules are: (*b*) *In typhoid fever the body-weight increases during the prodromic ascension of temperature;* an

increase which represents the retained urine, fæces, and sweat, and the great quantity of liquids absorbed during this characteristically thirsty period.

(*c*) *The body-weight rapidly decreases from the fourth to the fifth day*, though urine remains scanty, and perspiration is null, or limited to a spot, or at best to a region, because thirst is gone, appetite has not yet come, and diarrhœa has begun its draining course.

(*d*) *During an ordinary fastigium* (*période d'état*) *the weight remains stationary; during a protracted one it gradually subsides after the first septenary.* In the first case, the evenness of weight is maintained by the tendency of nature to equipoise its resources and expenditures; in the second, the loss of substance is due to the irretrievable deficiency of nutrition, which calls for *autophagism.*

(*e*) *In the defervescence of typhoid fever, when the temperature has come down, and the patient begins to eat, the body-weight continues yet to fall.* This fall indicates a continuation of the loss of substance, measurable from the kidneys, latent from the lungs, skin, and other emunctories, and permits to computate the necessary elements of repair.

(*f*) *Even in convalescence the weight is yet slow to come up when fever-heat is down.* But as soon as the patient can remain in the standing and walking postures, his weight increases abruptly, and then steadily, unless imprudent feeding, or a relapse, retards its tendency towards the previous healthy standard.

(*g*) *In pneumonia the body-weight falls during the all period of ustion* (effervescence and fastigium); *and more in the defervescence*, owing to the abundant flux of urine which heralds this period.

(*h*) *In variola the œdema coincides with an increase of weight*, which subsides when the pustules are drying up, and when diarrhœa sets in.

(*i*) In the exanthematous fevers of children, like *scarlatina*, *a latent anasarca or intestinal dropsy is rendered evident by the increased weight of the patient.*

E.—PARALLELISM OF TEMPERATURE, BODY-WEIGHT AND BODY-HEIGHT IN CHILDREN.—Since Spallanzani, this has been studied and tabulated again by Lorain and Quinquand. This parallelism contains informations of inestimable value for rearing

children. The concordance of these signs gives security; their discordance affords opportune warnings somewhat in this wise: (*a*) In children with a normal temperature the body-weight and the body-height grow abreast, (*b*) though during the spring the height grows more, and in autumn the weight; (*c*) the parallelism reappearing in the meanwhile, unless deviated by some perturbation always written on the temperature. These eventful perturbations are indicated on the thermometer (*d*) either by a depression (sooner in the evening) which prepares for a stop of growth at first, of bulk too, if protracted, (*e*) or by pyrexia, in which the bulk will melt like tallow in the fire; (*f*) at the same time that the height has to be watched, since it may attain enormous proportions, or shrink under deviations, the while temperature increases, with more rapid pulse and respiration.

To see these curves, or the figures which they represent, is like following with our mind the fairy preservation of children through the perils of the growth-period.

Such charts of the simultaneous or contrasting development of the organs and functions in childhood, as I have seen at Dr. Lorain's, are almost unique; whereas each family ought to have them spread in the inner chamber: Homeric descriptions of the fights of mothers against the child-ravishing demon, Hyperpyrexia. (Between the writing and the correction of this, the good and great professor of the History of Medicine died; leaving his worthy wife to alone continue the drawing of the charts of the physiological development of their beloved children.)

I wish I could say more on the relations of thermometry to sphygmometry, spyrometry, etc., and thereby show more of the concordance and discordance of the functions in disease; but that *more* can be obtained only by substituting the unity of means of observation to verbatim reports or *olla podrida* thermographies.

However, with the imperfect means at our disposal, we were enabled to make sure that *diseases have their mathematics;* and now, by improving our instruments and methods of observation, we must soon be able to prove that *therapeutics, too, has its mathematics.* This truth, lurking in the medical mind since the beginning of our art, has fostered the origins of thermo-therapeutics.

CHAPTER VI.

THERMO-THERAPEUTICS.

Ce ne sont pas les remèdes qui nous ont manqué, ce sont les moyens mathematiques d'en doser le besoin et l'action.

Unfortunately, thermo-therapy partook in all times of the fate of clinical thermometry: the want of instruments of precision to measure both, ruined both. Without means of dosing it, it fell in the hands of sharpers, then into oblivion; and no sooner resorted to again by the force of its yirtue, it was blessed again in the name of Diana, or of Notre Dame de Paray le Monial, and sold for a panacea, in France, or in Indiana, Missouri, etc. But let it be known that the physiological virtues of water, etc., reside in properties measurable by chemical or thermic analysis, and our thermo-pharmacopœia will have nothing to envy in that of the ancients, and will surpass it in point of precision.

Thermo-pathology demands thermo-therapy, which finds its means of action in thermo-pharmacopœia. Those are the three terms included under the head of this chapter, Thermo-therapeutics.

I.—Thermo-Pathology.

The oldest distinction of diseases in pyretic and apyretic is also the newest, and, though imperfectly elaborated, suits us here.

(*a*) Hyperpyrexia is not only a very dangerous element in disease: it is the danger itself. It consumes, therefore can last only as long as combustible material remains; that is a question of mathematics. Also the substance of the muscles, myosine, is altered at 42—43, and coagulates at 44.45° C. (Liebermeister, Vallin). The blood coagulates at 43 (Veikart); its albumen

too, and its red corpuscles, in a state of decomposition, are represented in the urine by their hæmatine.

Though true, this proposition is subject to exceptions, resulting from vital resistances to the laws of organic chemistry—resistances which differ greatly in individuals. This power of living chemistry is well illustrated by the peasant girls who remained ten minutes in an oven heated to 140° C.=316° F. (Duhamel and Dutillet); by a woman, called the Salamander, who could keep her body above and across a fire during the time necessary to cook in front a roast of veal or mutton, and who seemed to enjoy it; etc., etc.

At 5° C. above *their* norme animals do not recover (Magendie, Cl. Bernard, Obernier); man helped by man's skill does. But here, more than anywhere else, the danger of the *degree* is aggravated by that of the duration. So men may recover from a short exposure to 44.45° C. (Currie), and not often from a protracted one to 41.5° C. (Wunderlich).

(*b*) Apyrexy is not only a dangerous symptom in a number of diseases, often it is the disease itself. It initiates grave fevers; great and rapid falls are warnings of imminent death; death may come from algidity alone; though generally man can stand more degrees below than above, it depends a good deal on the rapidity of the operation, which is unfavorable, and of its shortness which diminishes the peril.

(*c*) Next in order comes the danger of extreme differences between the central and the peripheric temperature, which calls for, and finds ready the varied resources of thermo-therapy. But more delicate to manage and modify by treatment are (*d*) the excessive diurnal or tidal écarts, (*e*) the high and low distances from the norme at which the diurnal movement or stand-still takes place, (*f*) the advance or retard of the exacerbations or of the remissions, and the comparative and changeable length of both.

(*g*) Then according to the period of the pyrogenesis the same degree, or the same series of degrees, will require different, even opposite treatments.

§ II.—Thermo-Therapy and its Pharmacopeia.

The mind may sometimes indulge in classifications which the logic of language cannot sustain. I find it to be the case with thermo-therapy and thermo-pharmacopeia, which it would cost a deal of repetitions to treat separately, then together. The anomalies of body-temperature just synthetized have to be met with their antidotes; in broad terms, hyperpyrexy to be encountered by coolings, and apyrexy by warmings. And going deeper in the principles, we would say that the medication must be antidotal, not only of the ruling anomaly of ustion, but of its most intimate cause, which is either *ill distribution*, *waste*, or *non-production of calor*.

Happily our means of action on disordered temperatures are not all as recent as the study of temperature itself. When a new light dawns upon an old art—as the light of thermometry on therapeutics—a surprise is felt at finding that the ancients acted precisely as if they knew what we are proud of having discovered. This concurrence is due to the solidarity and solidity of traditional and recent observations; be they made from the standpoint of the circulation or of the ustion, they concur to the same end—the restoration of the functional *normes*. Therefore—and so much the better for it—most of the means of antipyretic medication have been tested by ages of empirical success, under the name of antiphlogistics, for instance, before they could be demonstrated apyretic by the mathematical method. Let us survey them first.

CHAPTER VII.

APYRETIC MEDICATION.

The elevation of temperature being the synthetic character of fevers, the direct object of an *antipyretic treatment* is to oppose this rise. So when we witness hyperpyretic temperatures the first idea—which takes possession of our mind like a duty—is to put it down. The second is to inquire how; a query which brings in its train a higher one: what is the source of the hyperpyrexia? . . . For if it originates in an over-production of heat, we must employ the means which can diminish or suspend the supply; if in excessive oxidations, those which retard the metamorphosis of tissues; if in retention of calories, the means of opening to them the ways of radiation and of various secretions; if in an ill-distribution of heat between the centre and the periphery, the means of restoring the equilibrium. And though the same thermic exaggerations have to be met by very different means, according to the circumstances and time of their production; and the same means may be used against pyrexy as well as against apyrexy; however the anti-pyretic medication is a *therapeutic entity*, whose recognition as such gives the efficacy of cohesion to its otherwise scattered means.

§ I.—Means Opposed to Hyperpyrexy.

(*a*) In *general hyperpyrexy* the horizontal position puts a stop to activity, and does away with its sequelæ, combustion, proportionate loss of calories, and *déchets* (organic detritus). It relaxes the muscles and the skin, the latter becoming more open to perspiration. It equalizes the central and peripheric circulation, harmonizes the rhythm of the breathing, and scatters the congestions of the nervous centres, which functionally

cause cerebro-spinal meningitis, progressive atrophy, paralysis, insanity, and leaves on the organs its indelible marks, sclerosis, etc. Horizontal rest is the anti-pyrogenic by excellence.

(*b*) In *local hyperpyrexy:* If located in the viscera, the body must be kept high, the limbs low, even hanging and loaded with an afflux of blood. If located in the extremities, these must be kept high and cooled, the body low and warm; same treatments for the head.

(*c*) An appropriate ambient temperature, the purity and equality of a wholesome atmosphere.

(*d*) Next comes the diet, apyretic by denutrition, and indicated at first by the natural horror of the febricant for animal or solid food, later by appetences whose indications are often precious. Under this head comes also the liquids to be ingested or injected. Their qualities depend on many conditions; their quantity must be to a great extent regulated by the quantities of moisture exhaled by the radiated heat (as per thermoscope), with the various secretions and excretions.

(*e*) The modificators of nutrition, by relenting the exchange of tissues and the consequent oxidation, and by diminishing the losses of carbonic acid and urea. These agents of direct or indirect retardation of nutrition are many and powerful; among them is the large class of alterative remedies, gradually brought from fractional to the high doses of contra-stimulism; certain preparations of mercury, arsenic, antimony, tea, coffee, alcohol, which in large and repeated doses not only retard the oxidations, and thereby lower the temperature, but diminish the frequency of the cardiac and respiratory movements.

(*f*) The cardiac moderators, digitalis, quinine, conium, aconite, veratrine, delphine, etc., are powerful though indirect anti-pyretics, mainly retarding the denutrition; so do the salts of potassium. Adding to this some metal and metallic combinations, several acids, as the carbonic, the acetic, oxygen, ether, chloroform, chloral in various combinations, we have indicated the principal remedies known to cause frigeration—by direct or reflex action, it does not matter here—but whose action on the body temperature is not yet represented in figures. And that is the next progress demanded of positive therapeusis.

(*g*) Bleeding is now rarely resorted to; it may justly be dreaded, but cannot be expunged from our list of remedies, since Nature keeps it on her own. Even latterly it has found

advocates, who try to make it reconquer, as an antipyretic, the position it once occupied as an antiphlogistic. They failed, of course; but even this failure was a triumph, for it caused the invention of the sphygmograph, cardiograph, etc., by Vierordt and Marey, which surpass the sphygmometers of Jules Herisson and Blundell, as much as Lorain's little book *on the pulse* surpasses the four volumes of Bordeu. But, after all, this superiority is the men's, not the doctrine's superiority; they—the men—succeeded in raising the ostracism pronounced against bleeding, but not to restore it to the presidency of therapeutics. Thanks to their efforts, the part played in the Natural History of man by phlebotomy will remain above contest; and when the lancet will be called into requisition—thermometry and sphygmography accounting for the loss of every drop of blood—its action on the temperature shall be supported by such a force of apyretic evidences, and its direct bearing on the circulation demonstrated by such sphygmographic testimonies, that it will no more excite raillery, but admiration.

(*h*) Hæmospasia, instead of drawing the blood out, draws it *in* the parts where it is wanted, or *from* the parts where it is judged noxious. It is a method of displacement of the liquids of the body substituted to their drainage. Dr. Junod invented it about 1830, as a substitute for phlebotomy, then spilling much blood; it is now mainly a precious adjuvant to the medication by temperatures, which it modifies in *plus* and *minus* with mathematic precision.

When either of these effects of hæmospasia is desired, one of the *ventouses Junod* is applied to the part where an afflux of blood is wanted. It is at first filled with warm water, then emptied (the water being set apart in a measured vessel), and the vacuum is made. If the *ventouse* is partly of glass (which is desirable) one can see how far and how fast the integuments, deprived of the support of atmospheric pressure, become turgescent (red, swollen). The local heat increases, and the opposite parts of the body become correspondingly paler and cooler. The proportion of these and other alterations are measurable: the limb has grown *in vacuo* 6—10 centimetres larger at the calf than it was; the apparatus, filled again with the water, cannot contain it all: the quantity thus remaining being equal to the quantity of the liquids drawn from the rest of the body into that part kept in rarefied air; the axillary temperature

has come from 37° C. down to 36°—35°, even 34°; the pulse from 80 to 60, 50, even 40, and filiform; then insensible, even at the temple; the respiration from 18 to 14, feeble and gaping; the dulness of sensation has gone from anæsthesia to syncope. Such is the gradual physio-pathology of hæmospasia. But no sooner does the air re-enter the apparel, and the limb is raised, than all the functions are resumed; even the swelling has disappeared the third day.

As far as the blood is a factor of temperatures by its elements and its velocity, hæmospasia offers the most varied modes of pyretic and apyretic treatments. It is applicable to more pathological circumstances than can be named here: to congestions, inflammations, hypersecretions, neuroses, and especially to incipient infantile paralysis, degenerescences, algidity and reaction period of cholera; after contusions of the viscera and organs of special senses, in wounds, fractures, lacerations, shock, after operations, etc. Hæmospasia is employed, not only alone, but with adjuvants and as an adjuvant; like the other parts of thermo-therapeutics, it is not one of the *pathies*: it is one of the agents of positive medication. As creating artificial milieux, it could have been treated of as a part of meso-therapeutics, farther classed in the pyrogenic *materia medica*.

CHAPTER VIII.

WATER THE APYRETIC BY EXCELLENCE.

Though water is the best cooler of pyrexia, yet we must be prepared to find it too a warmer of apyrexia; and moreover, to see its effects so varied, often so contrasting, that during its operations we have to sound the pyrogenic ground with the thermometer, as the mariner does uneven sea-bottoms with the lead.

We cannot stop to describe, only to mention, the principal forms of bath—or better, the principal means of *using water as a carrier of temperatures to the body.* Locally we note: shampooing the head; sponging the chest, or other parts; local affusions and irrigations; ablutions or immersions of hands, etc., in alternately cold and hot water, the hot hammer; water-ligatures at the neck, wrist, ankle, etc., to modify the circulation at its passage; local applications of ice-bags and of boiling water; sitz or half baths. Generalized application: vapor and hot-air bath, ordinary bath in a tub, in a river, or the sea. Stagnant or current bath in Mayor's apparatus; all sponge-bath, wet-sheet and wet-pack, wet frictions, affusions, douches, and showers; dashes, and horizontal, lateral, and other sprays, etc.

Three of these modes of applying water will arrest us a moment: the rubbing with cold-sheet (50°—60° F.), which at first lowers the temperature, and soon favors the appearance of tardy eruptions in children, etc.; the constant irrigation, varied in its means, of which two—a barrel or bucket full of water, on a higher level than the bed, has a string (coming out from the bottom) whose other end is coiled over an inflamed part, where it spreads a uniform stream of regularly cool or warm water. I have seen my father (1825–1830) himself set up these appliances in surgical and typhoid cases for

peasants of the old Nivernois, who were not much more to be trusted to keep parts evenly cool, or warm, than the average of our urbane population. The other means of keeping the body not only equally warm or cool, but mathematically so, being a sort of bath, will be included under the following heads:

§ I.—Water as a Carrier of Temperature to the Body.

(*a*) Currie put young, healthy men, with 37° C. buccal temperature, in a bath at 6° C. In two minutes their temperature fell to 32°—31°, and four minutes later rose to 34°—35°. This gain of 3° could come only from the human heat-producing apparatus being urged to fill up the gap between the deadly 31° and the healthy 37°. But after this partially successful effort of nature the ambient frigidity overpowered the central heating power, and the body-heat fell again, in the next twenty-five minutes, to 29°. The subject being taken from this frigorific milieu (marking them 4.5°) and put in another marking 42°, it took him twenty minutes to recover his norme—the 37° wherefrom he had started.

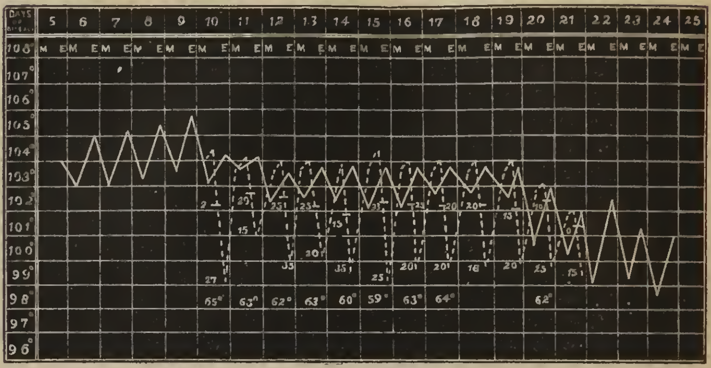
Neglecting the losses of caloric of both body and bath, we see: (*a*) 6° of milieu subtracting 6° of body warmth in two minutes. (*b*) The organism reacting by an over-production of calories regains 3° in four minutes (without reckoning about as much imparted to the bath). (*c*) But after this effort the organism, overpowered by the milieu, and exhausted of its means of heat-production, loses again about 3° in thirty-five minutes, falling to 29°. (*d*) Then in danger, he is transferred to another bath at 42°—that is to say, 5° above the human norme—where it takes twenty minutes to make him recover the 8° which separate him from his health starting-point, 37° C.

(*b*) Liebermeister and Leyden have obtained more exact results (see Bibliography), but very few physicians can have as complicated instruments as theirs; and as any one in possession of a thermometer, and with the disposition of a bathing apparatus, can apply the simple treatment of Currie with a sufficient degree of precision, I will give of it an example, and an average result. I take the example from the most recent publication of a case of typhoid fever treated by ice-water

baths, from W. H. Thomson and F. H. Rankin, in the *New York Medical Record*, Oct. 23, 1875.

Fig. 84.

EFFECTS OF EXTERNAL ON INTERNAL TEMPERATURES.



(On this chart the plain lines mark the mean morning and afternoon degrees, and the dotted lines show the effects of the baths. The figures at the top of the dotted lines indicate the temperature of the bath; the figures on the straight line indicate in minutes the duration of each bath, and the lowest figures indicate how many minutes after the removal from the bath to the bed the temperature continued to fall. The bath being at the freezing point, the first effort of nature to overcome its impression elevated the temperature for a few minutes, as seen by the rise of the dotted over the plain lines, but soon subdued it, as seen by their subsequent descent.)

(*c*) Here is an average estimate of the action of cold bath and of the ensuing reaction, by Glenard of Lyon:

Temperature before the bath	39.6
Immediately after the bath	38.4
One hour after	39.1
Two hours and a half after	39.4
Three hours after	39.6

This simplification must not deter earnest students from repeating and perfecting, if possible, the experiments of Liebermeister; but, practically, hydro-thermo-therapy is difficult

enough of itself, without rendering its approaches impassable to the mass of the practitioners by an array of mathematical and mechanical sphynxes, not unlike those which guarded the avenues of the temple of Isis (where physic was kept a mystery). To be plain, and understood by all, we will draw from the experiments of Currie, of others, and from our own, conclusions and warnings which are chiefly clinical.

(*d*) The temperature of the watery milieux (bath, etc.) *acts* upon that of the human body in proportion to the number of degrees which separate the two, and of the time of its application.

The stronger the external *action*, the quicker the internal *reaction* ensues.

When the external action has overpowered the internal reaction, two things will happen:

The first: After the body has been taken out from the milieu, it continues for some time to be acted by its temperature as if it were yet in it.

And the second: If the body has remained in the milieu after the temperature of the reaction was subdued, it is left powerless against the temperature of the milieu; a new reaction becomes impossible. A continuance, then, of the action of the bath-temperature calls for a watchful thermometry.

Extreme temperatures are heroic remedies, that may kill or cure; baths are their most ordinary carriers.

With extreme and short temperatures, beware of the reaction.

When the reaction commences, watch over its progression with your thermometer, and be ready with the most effective antipyretics.

To an extremely hot bath, nature opposes the cooling process of sweating of the alcarazas (cooling water-bottle). Against a very cold impression it generates a large surplus of heat, which makes it appear for a few moments as if an ice-cold bath really warms the body. But soon comes a reaction—which is really the action.

With extreme temperatures, protracted beyond the organic reaction, beware of the continuation of their effect, even after the body has been withdrawn from the bath.

After the reaction-temperatures have vanished, beware of the passivity of the body if further exposed to extreme temperatures.

Therefore, what is the most to be dreaded in the treatment by temperatures is not their first action, but their reaction, and later the incapacity of reaction.

Conversely, moderate temperatures may kill by not effecting the cure which high ones would.

Otherwise, the nearer the temperature of the bath is from that of the body, the slower will be the work of isothermization between the two.

And the slower this work, the longer it may be continued without danger of excess or reaction.

But if the external temperature is moderate, and the organic active, the latter will act on the former, and the former will be powerless to subdue the latter: here a large difference would do what time cannot.

Besides, in the treatment of sickly temperatures by water-temperatures, opposite means may produce similar results, and the same means may produce different results:

Warm water and vapor are pyrogenic, yet by inducing sudation they indirectly lower the temperature; so frequent sponging with warm water will cool.

Cold water, ice, and frigorific mixtures, etc., are antipyretics; yet by contracting the apparels of sudation and of radiation they prevent the peripheric evolution of calories, and by this negative processus they increase the central temperature.

These apparently contradictory results render *temperature* one of the most difficult remedies to dispense of all the *materia medica*. But once mathematically handled it is effective and exact in its effects.

Other difficulties, which I can but mention, arise from the dosage of local or general, uniform, contrasting, decreasing or increasing water-temperatures, and from the selection of its means of administration, as douches, vapor, lotions, baths of all kinds.

But the most difficult term of the problem of treating internal by external temperatures symbolized in water, is, not the knowledge of the changing virtues of the remedy, but that of the ever-changing (in disease) status of the inner caloricity. This is in order the second, in importance the first, element of thermo-therapeutics.

The live body, no matter how sick, has its own temperature affected—not isothermized—by the external. Far from being a

passive receiver of temperatures, as is the dead body, it produces its own calories, and distributes them unto itself in virtue of physiological laws, or imparts them to its milieux, in accordance to physical combinations.

This self-supplying and heat-distributing aptitude renders the body capable of living in temperatures sometimes higher, habitually lower than its own, and of resisting higher or lower milieux without becoming isothermal to them. We are thereby induced to consider physiological temperatures separately from, and superior in the scale of life and power, to mere physical heat, in proportion as organisms are superior to simple molecular aggregates.

This superiority is prominently expressed by the power of regulating the relations of the body's caloric with the external heat, the capacity of *accommodation.* Not meaning to say that alone in the human system the calorigen functions possess this power of accommodation, since it was first assigned to vision, and applies just as well to the functions of the brain, stomach, bladder, etc. But having no room for theories we say: the law of accommodation of inward to outward temperatures, and its monstrous derogations in sickness, makes it a duty for the physician to give the prominence to the study of the internal anomalies of accommodation over the fixed rules of action of purely physical temperatures.

This transfers our point of view from the objective to the subjective, and elevates the question of the treatment of diseases by temperatures to one of vital dynamics.

(*e*) In presence of the sick we must have constantly in mind his actual and ever-changing power of accommodation of internal to external temperatures: we ought to have studied what degree of calor-accommodation he had in health; how increased or diminished it has been since the sickness began; how much of the caloric has been wasted, retained, ill-distributed, etc., during the struggles for accommodation, and what remains of it for active service in the next conflict of the external with the internal temperatures,—in order to bring the latter to the physiological point.

In this struggle, let us remember, water is but a vehicle of temperature: its application is not hydro-therapy, but a part of thermo-therapeutics; its success depends less upon the degrees

of heat applied, than upon the masterly knowledge the physician possesses of the range of accommodation left to the body.

What is that range? We will try to answer this question in its generality, though keeping in mind that each case can alone give daily its own answers.

(*f*) When a person begins to show signs of sickness, either by high continuous temperatures, or by progressively higher ones with morning and evening remissions, his power of accommodation, not yet exhausted, rather exalted, will stand the treatment by temperatures in various ways, and even in excessive degrees. If he is of average strength, with no local determination of the blood, and had not been previously healing, he will be favorably affected by sharp and short temperatures, as 30° C. below his own, repeated as often as reaction indicates. If equally strong and of full habit, a temperature of 25° from his own will be borne better, longer, with less danger during reaction, than a more extreme one. If he has periodic headache, or occasional palpitations, an application of temperatures distant only 15°—20° from his own would be better borne yet, and as effective, supposing it to be continued longer.

But descending to the continuous applications of moderate cold—after a reaction, or in the absence of it—when the temperature of the patient has been actually reduced the half of the lowering presently desired, he must be taken out from the cooling milieu, because the other half of the frigeration is expected to follow *en suite*, as a wave follows another in rhythmic oscillations. Thus, if a febricant at $\underline{3}$° Ph.=40° C.=104° F. is put in a bath at 15° C.=59° F., as soon as he reaches $\overline{1.5}$° Ph. he must be taken out from the bath, and put to bed, with the expectation that his temperature will continue to fall almost as much as it has in the bath; that is, to the physiological zero.

This is quite a safe doing at such and at less distance from the norme. But supposing the pathological temperature to be decidedly higher, it would be dangerous to try to bring it thus, almost at a swoop, to the norme, as exemplified in the treatment of sunstroke, page 224. Thus, for safety sake, instead of starting from extreme temperatures, say 5° C.=41° F. applied a long while, at the risk of weakening beyond recovery the power of accommodation, we ought to undertake to lower it in successive antipyretic operations; each one subtracting .5° or 1° C. or so, and followed by bed-rest and food-support, during

which as much more may be effected by simple continuity: the distance between the frigerant operations being shortened if reaction threatens, the thermometer always being the judge.

As for the great majority of incipient pyrexiæ, they may be subdued by external temperatures nearer to the internal than is generally thought and practised—no more distant, let us say, than 10°—15° C. from the pathological, but on condition that they will not be withheld till they have produced their secondary action—past the reaction.

(*g*) When a pyretic disease has run its ascending course, its effervescence up to, and into its fastigium, or *période d'état*, it takes its principal characteristics from what remains to the patient of his power of accommodation; and from the manner we husband, utilize, neglect, or strain that *remnant* during the fastigium, depend the issues (then obscure, soon clearly readable in the figures) of the defervescence.

(*h*) Defervescence, though treated of by authors as a unit, presents to the thermometrician two phases rendered particularly distinct by their differences of accommodation. The first, in which the capacity of this function—though variable on account of the great diversity of the pyretic antecedents—is characterized by its dulness or passivity. The second—a forerunner of convalescence—marked by its prompt and delicate response to moderate thermic impressions: a distinction which must regulate the choice of the temperatures to be employed during the decisive fluctuations of effervescence.

Therefore, as long as the accommodation is inactive, or simply apparently inert (first phase), the temperatures employed to arouse this function have to be pretty sharp, yet quite short; but as soon as accommodation becomes more active (second phase), till it reaches a high pitch of sensitiveness, the water or other external means, employed to rise, or to subdue the inward temperature must come nearer to this latter, till it seems to act more by its sameness than by its contrast; and, sometimes also, more by tonic adjuvants than by its own pyrogenic capacity.

(*i*) This explains also why in convalescènce water is used, more for its stimulating effects than for its pyretic properties. Without entering into other details of application, it is easy to conceive, and to take advantage of, the preponderance of the mobile degrees of accommodation over the fixed properties of

outward temperatures, especially during the reconstructive efforts of nature to restore life by harmonizing warmth.

j.—Thermonomy of the Fall of Temperature.

1. The danger of a fall in temperature is in proportion, first to its suddenness, second to its degree.
2. A sudden fall of temperature in a febrile affection warns of an evolution, or of a revolution.
3. The degrees of the fall have a meaning—not the same at the beginning, in the middle, and at the end of a disease.
4. The circumstances attending the fall give its commentary; but its form expresses more particularly the nature and period of the morbid process to which it belongs.
5. A sudden fall indicates a tendency whose meanings depend first from its starting-point, and second from its mathematic progression.
6. A sudden fall in pyretic affections indicates a crisis.
7. A sudden fall in apyretic affections threatens collapse.
8. Any fall of several degrees is to be dreaded.
9. A progressive fall is favorable towards the norme, and dangerous below it.
10. Sudden falls in a chronic affection, or from a steady norme, command immediate rest, ready restoration and vigilant observation.
11. A great fall must not be provoked all at once (without successive rest and restoration), even to bring down the most excessive hyperpyrexiæ.
12. Any fall of temperature, ether natural or provoked, calls for a supply of restorative means ready at hand, since algidity is *per se* a cause of death.

§ II.—The Bath.

Though I resolved to restrict my remarks on the application of water to its bathing form, the bath itself is not a thing so simple, so well defined, so easily brought and kept to the desired temperatures, not even so easy to obtain when and where needed, and—I may hazard to say—not so generally well ar-

ranged, that it does not lend several weak sides to criticism, and therefore that it could not be improved, at least for medical purposes? In his article on *Typhoid Fever* of the Ziemssen's Cyclopedia, Liebermeister points out its uses and imperfections. He says, passim, Vol. I., pp. 205—230:

(*a*) "By far the greatest number of those who succumb to typhoid fever die from the direct or indirect effects of fever-heat: the true danger consists in the deleterious influence of a high temperature on the tissues which brings on their necrobiosis, whence paralysis of the heart, etc. In the antipyretic treatment is included that by cold water. It is immaterial in what way the abstraction of heat is accomplished. The means are not always the most effective which seem most energetic (referring to cold affusions, ice, etc.); on the whole, those will be found preferable which achieve the desired effect with the least inconvenience to the patient. For adults the bath must be 68° F.; if feeble, 75°. As the majority of the patients find the cold bath decidedly disagreeable, Ziemssen immerses in 95°, gradually reducing to 72°. Warmer for children. Nothing essential can be accomplished by one bath or a few. They do not reach the innermost temperature, or their action, too short, is followed by a reaction. Four to eight, sometimes twenty baths daily, and from forty to sixty in the aggregate, are needed. They must be given night and day, as often as the recurring high temperature demands it."

But here comes the counter indication: to *not move the patient*, and yet at the same time to bring him so often to and from the bath. The most important for a typhoid-fever patient, from the beginning of the attack, is complete bodily (and mental) rest. In severe cases, of those laid abed before the end of the fourth day, only five per cent. died; of those between the fourth and the eleventh, thirteen per cent.; and later, twenty-eight per cent.—*the laying posture to be continued till the body-temperature has proved to be normal at least from three to six evenings without interruption.* When moved at all, the patient must be lifted in the horizontal postures. Such are the dictates of Liebermeister; but how can we accommodate them to his prescription of bathing day and night the patient who must not be moved, etc., etc. Certainly the typhoid patient must be bathed, but he must not be moved; then how to bathe and to not move him? . . . .

Moreover, this ordinary mode of taking baths had other inconveniences which Liebermeister did not stoop to detail, but which had been noticed long before he expressed his views. We will recall (*a*) the difficulty of keeping the whole mass of water at the same temperature, and of making it warmer or cooler with any desirable precision ; (*b*) the danger of the spread of diseases by the effluviæ which water, particularly when warmed, communicates to the atmosphere ; (*c*) the impossibility for feeble patients to long remain in the positions imposed by the form of the bath-tub, and particularly to stand the continued pressure of several pounds of water over their chest.

(*b*) These inconveniences of the ordinary forms of bathing never appeared to me so glaring as when I saw the bath recommended in the remarkable book of Wilson Fox, and the same mode of bathing used to *apply temperatures as remedies* in several hospitals of Europe, even in the pavilions of Wunderlich. Then I felt encouraged to not throw away a suggestion which the lecture of the *treatment of hyperpyrexia* by Wilson Fox inspired to me, and which I published March 6th, 1872, in the New York *Medical Record*, under the name of its original inventor. It is the more necessary now to reproduce this idea in its entirety that no better one has been since devised, and that the medical papers are adorned with mutilations of it. There it is, shortened.

§ III.—The Bath without a Bath-Tub.

To facilitate the application of water, Dr. W. Fox insists upon the introduction in the wards of hospitals of movable bath-tubs, in which the patient could go, or be immersed, as near as possible from his own bed. This happy suggestion recalls to mind a mode of bathing which ought not to have been forgotten.

(*a*) *Les bains sans baignoire*, was the title of a little pamphlet handed to me, in the summer of 1835 or 1836, by a gaunt and weather-beaten Swiss physician during my introductory visit to him in a meagre lodging of the *Quartier Latin.* He was wrapped in one of those broad blue cloaks in which the Old Guard are represented falling at Waterloo. Under this historical garment he was taking his *bain sans baignoire* in a

double habit of flannel and waterproof. He never took any other, enjoying them especially when going on horseback to visit his clients, several miles away; and the three hundred and odd patients of his hospital used the same bathing apparel for many years and liked it very much: indeed, there was not a single bath-tub in the hospital of Lausanne.

For mine host was HE of whom it has been said: "There are two systems of surgical deligation—the one handed to us under the name of Hippocrates, the other Mayor's." He had come down to Paris to have one of his free fights upon his proposed improvements at the Academy of Medicine: this was Mathias Mayor's yearly recreation.

(*b*) Now it seems to me that this forgotten *bain sans baignoire* would be just the thing which, with slight modifications, would render easy in hospitals, and popular among the middle classes, the treatment of hyperpyrexia by *medical temperatures*, not only in public institutions, boarding-schools, naval, military, industrial, and scientific expeditions, etc., but in the homes of the many who have no bathing facilities. The apparel would consist of a covered reservoir of a few gallons, having inserted in one of its sides a rib of glass, showing the level of the liquid, and an ordinary thermometer to regulate the temperature of the latter. Hence, one pipe or more would let down the water into the bathing-dress.

This dress—which entirely enrobes the patient, even, if need be, his head and some parts of his face—is double, of thick flannel against the skin, and of vulcanized cloth outside. It is also open in the centre, like a pouch, to permit the insertion of the clinical thermometer in one of the natural cavities, at various points to admit the water from the reservoir, and at the feet and other declive parts to give it an issue into a covered receiver below.

This bathing-dress could be made as stout or as light as desirable; it could be so adjusted as to hardly hold two quarts of water, pure or medicated; mathematically warm or cold as per thermometer; stagnant around the body or streaming along it. It could be worn for hours, or days, in bed by the paralytic and rheumatic patients, or in the room, even in the open air, by those who need at the same time bathing and exercise. It is equally adapted to the five principal forms of whole-bath—the short, the protracted, the mild, the extreme, the progressively warmer

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or cooler. It most happily fulfils the desiderata of *continued mild frigoration;* I consider it impossible to read the thermography of the treatment of severe hyperpyrexiæ (see Appendix XIII.) without being convinced that as soon as they will have the means of doing so, physicians will give the preference to *continued mild frigoration* in the bathing dress to the *short and extreme ones* in bath-tubs, so soon and so often followed by reaction. Twenty baths in a day (Liebermeister) followed by twenty reactions, forty revolutions of temperature in twenty-four hours, constitute quite a rapid thermic *balançoire.* (Same remarks upon the fluctuations noted, page 224.)

Such appears to be, *prima facie*, the advantages of the adaptation of Mayor's *bath* to the therapeutics of the positive school of medicine.

(*c*) It seems that it would be doing an act of justice if we were to give to this bathing apparel the name of Mathias Mayor, who was never equalled for ingenuity in the mechanical department of surgery; and yet who met with so little of reward that, if he had cared a fig for a tombstone, he would have caused to be written upon his, "Woe to him who comes too soon."

For the reader who feels restive under the development of ideas and their deductions, let us condense in facts and figures the most recent—

§ IV.—Results of the Treatment of Hyperpyrexiæ by Low Temperatures.

Names.	Localities.	Diseases.	Number of Cases.	Number of Deaths.	Percentage of Cures.
Currie (1804).	Liverpool.	Typhoid fever.	229	4	2 per cent.
Jacquez (1839).	Lure (France).	Typhoid fever.	313	12	4 "
Brand.	Stettin.	Pernicious fever.	170	0	.. "
Jurgensen.	Kiel.	Typhus.	60	0	.. "
Liebermeister.	Basel.	Typhus.	478	8	2 "
Ziemssen.	Erlangen.	Typhus.	..	..	7 "
Lindwurm.	Munich.	Typhoid fever.	120	..	4 "
Bamberg.	Vienna.	Typhoid fever.	..	..	6.6 "
Winternitz.	Vienna.	Fevers.	40	0	6.6 "

From a great many observations Cl. Bernard establishes the proportions of mortality to twenty-three per cent. by varied treatments, and of nine per cent. by the water treatment.

Now we could expatiate on the use of water as a conveyer of high temperatures to the body as we have on its frigorific properties. But the same modes of propagation rule both ways, and the revival of the peripheric circulation by hot bath (86°—104° F. = 30°—40° C.) is so well known, that Homer describes its use to restore the circulation of the teguments in old people (Odyss. XXIV.). It is not the ancients who did not know; it is we who have forgotten.

CHAPTER IX.

PYRETIC MEDICATION.

A PYRETIC treatment consists either in the means of adding heat to that of the body, of inciting the inward generation of heat, of preventing its excessive escape, or of equalizing it all over the body and limbs. The means to these ends are many; we will see a few.

(*a*) Like water, alcohol and its congener, wine—which I have hardly room to name—act as a double-edged sword in thermo-therapeutics. In certain pathological conditions it supports, in others it depresses the temperature. This double property was divined by my Burgundy ancestors, who would urge the acceptance of their national beverage by saying in winter to friends and visitors: "Take a glass of wine: it will warm you;" and in summer, "Take it: it will cool you." Truth from the heart, confirmed by science, but not yet reduced to a system. In toxic doses it depresses, in small it raises the temperature; in therapeutic doses it sooner prevents the deperdition of heat. It does not act on the sick as on the healthy, nor in all diseases alike. In the absence of absolute rules as to quantities and their effects, we have to watch these effects by the light of thermometry to decide on the doses.

(*b*) Food is as much a part of the pyretic medication as fasting is of the antipyretic. But how much easier it is to refuse satisfaction to the demand of nature for it, and count the results on the thermometer and sphygmograph, than to measure the difference of ustion produced by different kinds of food. In this last selection we are guided by a good many prejudices and a little positive knowledge. However, the little we know is precious; and I am persuaded that if all those who die of starvation in sickness (not by privation of food, but by want of the proper food as a heater) could rise, no medical student would

afterward receive his diploma without having passed a solid examination on the art of feeding and of keeping warmth by food.

(*c*) Spices, aromates, odors, rank between food and medicine, being allied to both. Introduced into Europe by the savant companions of Alexander, early sought for by the golden youth of Rome, incorporated in the imperial theriaca, they retained a costly supremacy in the polypharmacy of the middle ages. Now we laugh at their pretended virtues, and have almost forgotten their real ones. However, being the products of high temperatures, they must have sunny qualities. For instance, medicines act quicker and more thoroughly with diffusible aromatics than without, whenever the sympathetic needs to be aroused, like in cholera. I would not affirm that so many Roman emperors were murdered because their theriaca prevented them from timely enjoying a natural rest, but I have seen lives apparently protracted by the use of aromatic preparations; there are more rays of a beneficent sun than we can count in a little clove, but we can measure the heat it imparts to our bodies; thermometry is called here, too, as a judge.

As for the odors and perfumes already dispensed as drugs, there is a whole pharmacopœia, from neroli to valeriana, from tolu to assa. Their properties are called nervine, but beyond that vague qualification, and the other, more ambitious, of being aphrodisiac, some act on the temperature by lowering it, as do jessamine, otto of roses, musk (which is hardly inferior to quinine on that score), in virtue of the law discovered by Brown-Séquard, that a nervous excitement causes frigoration; others keep up or increase the heat. The relations of odors to calor are intimate; their reciprocal convertibility is demonstrated in some cases, beyond which we have yet everything to learn. The action of the body's emanations due to an occasional development of caloric would open a new chapter. Sufferers from melancholy have been revived by it, and others have been like paralyzed, as it happened to King Henry III. of France, by the immediate contact with a piece of the garment of Mary, Princess of Clèves.

(*d*) Vestment, considered as a means of warming or cooling the body, belongs to this part of our subject; nevertheless, we will give its place to other pyrogenic agents, apparently more important, certainly not of such general and constant utility;

for the same reason, likely, that people are moved to awe by the presence of a coarse surgeon who can sever a limb in one minute, and before the physician who spent his life transforming sore-nosed and sore-eyed children, neck-laced with scrofulous beads, into faultless brides, they feel.... *rien du tout.*

(*e*) I called the attention, first, on the pyrogenic properties of the hot hammer, or *Marteau-Mayor*, from the name of its almost forgotten inventor. It has no connection with the red or white hot cautery, the moxa, nor anything that burns; it only warms. This energetic and expeditious means of accumulating heat is indicated when the circulation is impeded, or just stopped, in embolism, certain forms of apoplexy, defervescences with collapse, central algidity, sclerema, cholera, and wherever (except in internal hæmorrhages) the quickness and feebleness of the pulse is associated to a fast-falling temperature. Even in agony it is known to accumulate heat enough to permit the departing to remain a little longer, in order to perform a last duty; indeed, it is to that effect, and with that result, that Mayor first applied the hammer in medicine.

Modus operandi.—It must be clean, if not new; kept in boiling water long enough to come to its degrees, 100° C. = 212° F., of which it will soon lose a few by exposure. It is generally applied at the pit of the stomach. The place must be dried from moisture, and covered with a piece of muslin, linen, or paper, perfectly dry too; for any humidity included between the body and the hammer would vaporize at a higher temperature than the latter, and *burn*, instead of *heating.*

With these precautions the hammer is softly applied till the superficial layers of tissues have become isothermal with it. Then, and not sooner, the hammer is pressed more and more, in order to make the heat penetrate deeper and deeper, farther and farther, till the desired impression is obtained. When the operation need be protracted, one hammer is at work and another in the kettle; the linen is watched and changed as often as it becomes humid. An assistant takes the general and local temperatures. Besides its use in ultimate and solemn circumstances, the pyrogenic hammer will be used with advantage, if I trust my personal experience, when heat is wanted generally or locally; for old people in periodical collapses, without reserved heat to support the reaction; for children cooled by

rapid growth, at the end of a protracted winter; when food has been scant; to facilitate digestion; to arouse the sympathetic in melancholy, in some forms of hysteria, in secondary and tertiary syphilis, etc.

(*f*) Transfusion, or injection of some liquid in the veins, after its first applications in 1660 by Denny, of Paris, has been in turn favored and neglected. The substances thus introduced in the liquid form were oftener warming than cooling: we will mention only solutions of chlorure of sodium, warm milk, warm water, defibrinated or quick blood from another's vein; and quote:—Magendie, in 1840, injected water in the veins of an hydrophobe, who immediately rose from his bed, went to the fountain, drank, and lived eight days longer—through peripeties of better and worse. Lorain, in 1865, injected 400 grammes of water at 37° C. in the vein of the forearm of a choleric; cyanosed; temp. in mouth 26.8° C., which immediately rose to 30° and on the morrow to 35.9°. The pulse began to be felt, cyanosis disappearing; hiccough ceased the third day, diuresis was restored the fourth; cure (from St. Antoine's Hospital Reports). There is more recent records of success from various quarters, but published without reference to the first temperature found, and to those obtained by the transfusion.

(*g*) What we said in Part 1, Chap. V., dispenses us from entering into long details about *Mesotherapy* (prophilaxy or cure by the milieux). Insects build or burrow North or South, high or low for their winter or summer residences; and birds migrate according to mesologic laws, besides selecting the winds to sail with, their camping shelters, etc. In this wintry season my black angora lounges where the sun shone several months ago. Man, when a brute yet, descends from the northern plateaux to bask on the hills golden or purpled by the grape. The Cossack feels that he must soon wash his tallowed beard in the warm waters of the Bosphorus, and his fleet horse, given the spur that way, neighs at the prospect. The pale men found the red men at their Saratoga water-cure, but our artificial wants have obliterated our natural *besoins*. What the wild goose seeks unerringly, we must ask from science. Unfortunately the earth has been more prospected for gold than for health; though mesotherapy has always been considered the great achievement of our art. It employs to cure, and

better, to breed finer men, the physiological effects of longitudes, latitudes, altitudes; of expositions in relation to the sun, the winds, the rain-fall, the fogs, the direction of the surface and subterranean streams, the stagnation of others, the effects of pollens, of living or decaying vegetation. We know that climates good for invalids may be deadly for infants; that where a baby will prosper till fifteen months old, his chances of death are increased tenfold from thence to four years; that a *milieu* favorable to laziness is fatal to activity, or *vice versa;* that exposures which kill one, invigorate the other; that a region where incipient consumption cures, hastens the fatality of the more advanced; that where an adolescent will develop, another will pine away; that finally, in these decisive questions, the thermometer and the hygrometer must take the place of our anæsthesied natural propensities. But how far are we from mastering those problems? On one hand, men travel far more for wealth than for health; on the other, those competent to advise in such matters are few, and the writings are scattered on rare pages (See Appendix XX., Leurtet, and Bibliography, Paul Bert, Quetelet, Bertillon). Meanwhile Mother-Earth remains before us like the Abundance of P. P. Rubens, in the Medicis Collection, covered with mammæ, from which, in our ignorance, we suckle either milk or poison.

(*h*) I can only give a few lines to the pyrogenic properties of electricity. Let us only remark that some of the mysteries which surround its application to our art are explainable by Mayer's, Jouley's and Helmholtz's theory of the identity or convertibility of the forces. As others convert this force into light, movement, and an infinite variety of laboring powers, the physician introduces it into the human system as a spark; whence it comes out converted into contractility, sensibility, and other forms of physiological and psychological activity. I would say nothing of its general and surgical applications; but the necessity of using thermometry as a local application is obvious. When the sap of life abandons a part or limb—which is proven by a lowering of the temperature—electricity shows its power of restoring communications, by running its currents through the forsaken ducts. Then the cold part is warmed, the inert limb is moved and fed again; a new life is infused with the spark into the lifeless organism. But it is not always so; and between necessary failures to be palliated, and success

claimed where little or nothing was accomplished, who will judge? . . . Sorry sight, described by Cyon in his preface of *Principes d'Electrotherapie*, Paris, 1873, to prevent which the shortest means is by submitting the operations of this new treatment to the sure test of mathematical thermography. To this effect one can use the following:

(*i*) Table of Pyrometric, Dynamometric, and other Observations during the Use of Remedies.

	18....MONTH......	NAME.				AGE.				SEX.			REMARKS.
	Day of application...												
	Pulse*.......Before												
	" ....After.												
	Breathing....... B												
	" ....A												
Temperature of	Right hand........B												
	" ....A												
	Left hand.........B												
	" .... .. .A												
	Right axilla.......B												
	" ....A												
	Left axilla........B												
	" ....A												
Contractility of	Right hand † .....B												
	" ....A												
	Left hand.........B												
	" ....A												
	Right foot‡.. ... B												
	" ....A												
	Left foot..........B												
	" ....A												
Æsthesiometry of	Right cheek§......B												
	" ....A												
	Left cheek........B												
	" .... A												
	Right arm........B												
	" ....A												
	Left arm..........B												
	" ....A												
	Mensuration of.....												
	Urine, sp. gravity...												
	" oz. per 24 hours												

* Also the Sphygmography of the right and left radial artery, taken once or often.
† Measured on the Dynamometer.
‡ Measured on a swing fronting a vertical spring-board, alternately pressed by the right and left foot.
§ Or other points of observation.

CHAPTER X.

MEDICAL MATHEMATISM.

This table—specimen of others—can give an idea of the philosophical part an omnipresent thermography can act between pathological temperatures and thermo-therapy. It will, besides, become the test by which will rise or fall that pretender to the succession of medical scepticism, theurgism, thaumaturgism, and empiricism, *medical positivism* or *mathematism*, or whatever may be its name when success will have given it one. No other instrument of positive observation will have so large a share in this revolution as the thermometer, and the mathematical treatment of its findings, thermography.

To therapeutics, thermometry opens a new era more promising than the one opened by the discovery of America. To the latter we owe the acquisition of the Peruvian bark and balsam, of the Mexican ipecac and jalap, of the mandrake and curare, etc.—valuable specifics added to the list of the empirical arcanes: for arcanes they are in their action. But to thermometry we owe the mathematical regulation of the powers of two medicines, *heat* and *cold*, the productor of warmth and the retarder of combustion, whose action on normal and abnormal temperatures becomes as positive as can be any operation of statics, hydraulics, or chemistry. With thermometry, heat and cold, antithetic terms, or poles of the force-temperature, are convertible into movement, activity, thoughts, feelings, and all the manifestations of life. In showing us how to use them mathematically, thermometry has truly discovered—according to the vivid expression of Wunderlich—*a new world*, the one dreamed of by De Haen and Currie, *the law* of the action of external upon human temperature. But this therapeutic application of the two antipodic terms of caloric to the treatment of diseases is only the initial impulse of an immense revolution, whose

subsequences, hidden to the view of the far-seeing Currie, are hardly traceable in our horizon; I mean the calorific and frigorific action of all our medicines, vegetables and their alkaloids, metals, metalloid bodies and gases. This entirely new field of observation and of therapeutic action would vanish like a mirage if thermometry could be suppressed. But, far from this impious impossibility, thermometry will find out even the positivism hidden in empiricism, by demonstrating the law of concordance of the apparently most discording treatments; and it will reconcile schools which were divided, only because they did not know that their diverging means converged to the same action and object, viz.: the keeping up of normal temperature, that is to say, life; and the suppressing of the sources of pathological temperatures—that is death, *in propria persona.*

§ I.—Position of Thermometry in Diagnosis.

Though and because the first part of this book is consecrated to the exclusive demonstration of diagnosis *by* thermometry, now that the demonstration is beyond cavil, it becomes necessary to reconstitute diagnosis on its old solid materials, after having only substituted thermometry to sphygmometry for its corner and central stone.

Henceforth, at the bed-side, the first act of the physician will not be to feel the pulse, but to apply the thermometer; he will not proceed to percussion or auscultation before having collected in his nares the emanations always indicative, if not of the disease, at least of the degree of saturation by the morbid ferments; as does and professes Behier at the Hotel Dieu of Paris.

Then, when the other *medical senses* will have made their survey, sphygmometry may be the first operation next to sphygmography, around which will stand, as the case may demand, the cardiograph, the myograph, or other of the registering instruments (instruments inscripteurs) which exercise the ingenuity of many earnest students in the laboratory of the *College de France.* This activity, of which Marey has wrested the leadership from Germany, and the recent progress accomplished in the chemical laboratory, bring to thermometry the means of branching in two directions.

By the comparative study of the *concordance* and *discordance* of the three great vital signs, and by the concurrent use of the thermometer with the sphygmograph, the myograph, the microscope, the æsthesiometer, the dynamometer, and other instruments and methods of *positive diagnosis*, we will soon be able to settle, like mathematical affairs, all questions relating not only to disease, but to vitality, longevity, and adaptability to the various climates, altitudes, longitudes, training, studies, sports, indulgences, labors, individual and social fitness.

Moreover, the range of its diagnostic powers has been and will yet be greatly extended by the combination of its action with that of the instruments and methods of *physical diagnosis.* This combination of the surface and the fever thermometers and thermoscope with the stethoscope, laryngoscope, specula, plessimeter, etc., will bring into focus many facts which, scattered, had no possible diagnostic connection. I cannot diverge from my central objective point to dwell upon the consequences of this alliance of thermometry with physical diagnosis, but I can spare a few paragraphs to indicate some of the operations which the thermometer can accomplish at the head of, and in collaboration with, the instruments and methods of positive diagnosis.

II.—Physical and Positive Diagnosis.

But first, as I have originated this division of the instruments of diagnosis into *physical* and *positive*, I may be allowed to support this proposition by considerations which will, in my judgment, altogether enlarge and specify the functions of the thermometer itself.

The instruments of *physical diagnosis*, stethoscope, ophthalmoscope, specula, etc., are always, like spectacles, *accessory to our senses*, to which they give a farther reach and a finer accuracy.

The instruments of *positive diagnosis*, the microscope,—for a part, at least, of its investigations,—thermometers, dynamometer, etc., are *substitutes to our senses*, and give automatic results which cannot be influenced by the personal modalities of the senses or of the mind.

Practically, the results obtained *with* the instruments and methods of physical diagnosis are the expression of individual sensory impressions rendered in the individual's own language—impressions and language which necessarily vary from man to man, and cannot be finally adjudicated by a more stable authority. From this *modus operandi* arise all the doubt and controversies consequent upon auscultation and percussion; what is perceived through the stethoscope can be controverted.

Practically, the result obtained *by* the instruments and methods of positive diagnosis are given out by the instrument itself, in traces, figures or diagrams which the imagination of the observer cannot alter, nor his power of rhetoric enlarge or color (deliberate lying excepted). Their arithmetical or geometrical results will always come out identical, when taken in identical conditions; and though taken by several observers and with different instruments of positive diagnosis, they will sustain among themselves a concordance that bespeaks truthfulness, and which, moreover, could always be controlled from whatever distance. What all the instruments of positive diagnosis indicate are unchallengeable indications, which it remains only to read and interpret correctly; what the thermometer says no man can contradict.

From this it appears that the instruments of physical diagnosis may corroborate but not invalidate the testimony of the instruments of positive diagnosis; but that the latter can reaffirm or negative the findings of the former, and even can testify of pathologic symptoms on which the other remained yet (as is often the case in consumption) silent or doubtful.

Another practical difference between these instruments is that those simply physical are more fitted to give an account of signs and symptoms *as they are*, and the positive ones *as they will be*, also. Thus auscultation, speculation, etc., afford an idea of the present state, but unless frequently repeated furnish uncertain and disputable clues to the progression and durability of affections; whereas the operations of the thermometer, æsthesiometer, etc., need hardly be repeated twice in ordinary cases, to permit the prediction of distant issues. Therefore the former are decidedly best—but not exclusively—adapted to the diagnosis of actual diseases, and the latter more pointedly to the pre-diagnosis (in a certain sense a prognosis at longer range than usual) of the deficiencies and wastings of

vital forces which threaten longevity) not so suddenly, but more surely than disease itself.

Here thermometry and its allies in positivism almost cease to be medical; become human, social, commercial, and the most direct agents of progressive morality. I cannot, of course, follow thermometry through all these new fields of observation, even at the speed of the previous suggestions; and must content myself with the delineation of a few of its most important new features, commencing by those which directly interest the healing art.

§ III.—Prognostication by Thermometry.

No part of our art is so interesting as prognosis. For Hippocrates, the best physician is the one who prognoses best; and none made such powerful prognostications as his, which became our fundamental aphorisms. Such is the origin of our store of sapience, to which the antiquity, including the school of Salern, added little; the Renaissance, including Sydenham, a few sentences; and which thermometry has already enriched by some prognosticant aphorisms.

a.—Prognostications in Disease.

The Master had said: "The signs of improvement must not appear too soon."

A true crisis (our defervescence) must come after the two first periods (the effervescence and the fastigium); if sooner, it is a cause of complications, the period of augment not being well exhausted.

What remains of the disease after the crisis causes the recidive or relapse?

Critical phenomena without true crisis predict a difficult or fatal issue, etc. The moderns have not been able to negative any one of these magistral sentences, but have more or less reaffirmed them with the help of thermometry. Wunderlich did it in many circumstances:

Everything else being equal, the danger is commensurate to the distance of the mean temperature from the norme.

A series of temperatures at 42° C. prognosticate death.

A series from 40° to 41° C. prognosticate nine deaths out of twenty cases.

When 43° C. is reached, death was unavoidable (Wunderlich) previously to the strict antipyretic treatment (W. Fox, Da Costa).

A fatal issue generally follows a series of temperatures from 40° to 41° C. (Hirtz).

A fatal issue generally follows several temperatures of 41.9° C. (Hirtz).

When the heat rapidly increases in the effervescence, it will decline according to the same ratio in the defervescence (Hirtz).

When the fever-heat develops slowly, it prognosticates a slow decrement of a protracted disease.

When the temperature affects a continuous type, let us beware of a grave affection.

In typhoid fever, if no remission appear in the latter part of the first septenary, the prognostication is grave (Thierfelder).

A great excursus between the morning remission and the evening exacerbation offers a favorable prognostic (A. Beau).

In forming a prognosis about children, we must always remember the extreme mobility and exaggeration of their morbid ustion (Roger), and the reverse about old people (Charcot).

Here is from Hirsh a tabulated series of prognostications, which we reproduce for their intrinsic value, but more particularly as specimens of what any one of us can condense from his private experience:

(*b.*)—Prognostication from the Length of the Periods in Ustions.

	Signs.	Significances.
Rapid.	Effervescence..2 to 3 hours Fastigium....4 to 8 " Defervescence.2 to 4 "	An access of intermittent, ephemeral fever, febricula.
Quick.	Effervescence..2 to 3 " Fastigium....4 to 8 " Defervescence.1 to 3 "	Acute inflammatory disease; pneumonia, angina, pleurisy, typhus, scarlatina, rubeola, etc.
Slow.	Initium......3 to 5 days Fastigium....2 to 3 septenaries Defervescence.3 to 5 days	Typhoid fever.
Jerked.	Initium......3 to 5 " Fastigium....2 to 4 septenaries Defervescence.3 to 7 days	Rheumatism and anomalous fevers.

These types can combine by borrowing one period from one another.

The march of one stade indicates another as follows:

A rapid or short effervescence indicates a fastigium and a defervescence equally short, like in intermittent.

An initial period of twenty-four hours prepares for a fastigium of a few days, with transient delirium in some inflammatory fever, like a typhus.

The slow and gradual invasion belongs to typhoid fever.

The same computations applied to the second or third stade could afford quite as good an insight into the previous ones, which the physician had no opportunity of observing.

(*c*.)—Prognostications by Thermometry during the Incubation of Diseases.

Prognostication must be supported by *prenotions;* and no prenotions, or warnings of danger come earlier than those given by thermometry. This new power was demanded, that is to say, predicted by Claude Bernard: "Physic would have made an immense progress if it was rendered capable of foreseeing in health the morbid dispositions, and thus warning of impending danger" (*Principes de Pathologie Experimentale*). Nearer to practical medicine, W. Squire judged that "the investigation on the temperature-changes, preceding the diseases of infancy, may increase the certainty of our diagnosis, and give us the power of identifying at the outset those diseases most requiring early recognition, and of preventing the spread of infections" (*Temperature Variations*, etc.)....."The study of all what pertains to the ingress of disease may be said to commence"...., etc. (*The period of infection in epidemic diseases*, London, 1874). To the same sagacious observer is due part of our knowledge applicable to prognostication during the period of incubation, and to the possibility of restricting infection in the narrowest limits, particularly among children.

The diseases which have a short incubation—scarlet-fever, diphtheria, plague, cholera, yellow-fever, diarrhœa, influenza, dengue, erysipelas; and those which have a longer incubation: small-pox, vaccina, measles, rubeola, mumps, varicella, typhoid fever and typhus; also those which partake of both characters,

whooping-cough and relapsing fever—all these infectious and other communicable diseases, though different in other respects, agree in these: that their mode of incubation, long or short, has shown, as far as our studies go, two successive and well-differentiated periods:

A first one of *latency*, or of insertion of the virus—the poisoning proper—in which the germ is sunk in the system; and that of *pullulation*, or *proliferation*, in which new germs pervade the organism, which will try to throw them off by all its possible issues, or to comburе them by excessive ustions; either of which alternate efforts of nature we call *the* disease.

But this fruitful issue is often replaced by a fruitless one; that is, by an abortive fecundation of the virulent germ. Either the poison lacked the conditions of vivacity, or the system was unpropitious to its germination, and—almost or quite harmless—it is expulsed during a pseudo-crisis. So terminate the immense majority of cholera poisonings in diarrhœa or cholerine, of scarlatina and measles in roseola, of diphtheria in more or less benign tonsillitis, of variola in varioloid or varicella, etc. The seeds of diseases, like the seeds of plants, would destroy every other form of life—ours the first—if they were not themselves as perishable as any.

However, not concerned here with this conservative process, we are only trying to find out the effects, upon human caloricity, of the initial periods of insertion of these seeds, which, either being more viable, or having fallen in more favorable ground, will not only reproduce the pathological conditions they are heir to, but will spread far away their impalpable pollen-like germs. In this line of inquiry, thermometry has shown in a large majority of cases—yet not with such unanimity as to proclaim it a *law*—that during the process of infection the first period is innocuous, the second poisonous, and why?.... Because in the first period—that of insertion—the movement of the virus carries it from the periphery to the centres, not from the periphery to the surrounding tissues; is entirely centripetal, therefore does not possess the power of contagion; where it has been well observed, it was thermometrically characterized by a lowering of the temperature. And, conversely, in the second period, that of pullulation, the movement of the virus becomes centrifugal and communicable to the surroundings, even before it has made its appearance at the periphery; it is

always accompanied by a rise of temperature, whose initium and movement, once well established for each infectious disease, will constitute its thermic prototype. Then will be known the precise commencement and the duration of this period, in which the infected must be sequestered one way, and the exposed ones another.

Dr. Squire remarks on this subject: "The old quarantine of forty days, or six weeks' isolation, allowed to prevent those who have suffered from an infectious illness to carry it to others, singularly approximates the conclusions of experience." It may not be always found sufficient, as in severe cases of scarlet-fever, or may be excessive in other ailments; yet, as a general measure of security, allowing three weeks for the incubation and the course of the disease, and three more for the convalescence, the infected party must remain isolated about forty days. For those who have only incurred the possibility of infection, a much more restricted isolation is sufficient, from three days to three weeks. (See Appendix IX., *a*, *b*, *c*.)

But prognostication by thermometry does not stop at the prediction and prevention of *infectious diseases.* It equally detects, and can stop the inroads of *dialytic tendencies*, particularly those due to a discordance between oxidation and nutrition, and represented by the processi of incipient, or recurrent, or hasty tuberculizations and consumptions.

(*d.*)—Thermometry detecting incipient Phthisis and other Incipiences.

During *tuberculization* all the signs expected from the keenest recourse to *physical diagnosis* may be silent, whereas thermometry will give out the positive evidences of the consumptive processes of ustion. Sydney Ringer called our attention in 1866 to this superiority of the *positive* over the *physical* method of diagnosis, as permitting to establish the *prognosis* of phthisis before it is incurable. According to the talented professor of the London University Medical College, and notwithstanding quibbling objections, thermometry gives a *prenotion* of the impending danger in time to avoid it. In the three recognized forms of phthisis, the catarrhal, tuberculous and fibrous, the diurnal movement is this: temperature higher in

the evening than in the morning, irrespective of intercurrent fatigue or excitement; and later higher in bed early than up at noon, and worse again at dusk. And the course of the disease is marked generally more than once by a long-run movement of elevation during the formation of deposits; by a period quite normal when the morbid products cease to be formed; and another, even subnormal, when the elimination of these products leaves the subject exhausted—three periods which constitute the rotation movement of consumption. Ordinarily, the initial period of pyrexia is not missing, but missed by want of timely observation; and yet Sydney Ringer noted it twenty times out of twenty-four cases: whence he concludes that *these thermometric observations afford a delicate and valuable test of the continuance, the amount, and the cessation of tuberculization.*

It is readily understood that phthisis is but one of the constitutional degenerescences by consumption which may be reined up, *enrayées*, by the timely disclosures of pathological ustions by thermometry. I have room only for an illustration:

May B——, Hudson Street, æt. 7, growing fast, fond of reading, takes suddenly to her mother's lap as a baby; feels well nowhere else. Pulse frequent, harsh, almost rheumatic; no pains, no chills. Axill. T. .5° C., increasing in the afternoon to 1.5° at home, to 2° coming from school. Feet cold, hands warm; no transient flush on the cheek or ear; no cough; pupil dilated; slight headache; insuperable bodily languor. Undressed she presented three lateral curvatures, the largest deviating from the axis almost two inches. Allowed to lay on her back, and to exercise moderately every alternate hour; Liebright chair, fresh eggs, beef and veal broth, or jelly, every hour, besides the family fare; insolation and rest on the hot rocks of the Park. Two months later temperature almost even from morning to night (.1°—.2° C.); back almost straight; the child cheerful and active again. Had the temperature said nothing, there would have been no physical examination, and she would have grown distorted.

(*e.*)—Thermometry detecting Simulated and Dissimulated Diseases.

It takes a life's experience and exceptional opportunities to form an idea of the large part these exceptions play in physic, and of the difficulties encountered in detecting them, or in dealing with them. Some are ignored by the patient himself or his relatives, who attribute the incapacities resulting from the unknown cause to laziness, ill-will, etc. Some are the result of epileptic seizures known to nobody. More are dissimulated, to be kept in responsible or lucrative stations, to be admitted to the privileges of insurance, mutual associations, etc. But how many more feign a disease in order to be relieved from duty, to escape danger, confinement, hard fare, hard work, to regain freedom, to enlist sympathies, to exercise a moral pressure, to create a stir, to act sickness as a fine art, for lucre, or for the sole pleasure of deceit, or of being petted, pitied, etc. In this order of simulation there are constantly some people making it their business to live without food; cataleptics and epileptics at their own hours—not at yours; febricants, vomitants, rheumatisants, egrotants of some sort, in colleges, shops, prisons, asylums, navies, armies. Old Turcoes from Algeria can beat any doctor with the description of their last attack of tertian fever, but not impose on the thermometer a rise of 3° C. at the next access. Once 60,000 men out of 120,000 on the sick-list were playing possum in hospitals, actually paralyzing the American army, because thermometry was not applied to give them the lie, and send them to the front.

In this country more than anywhere else will be felt the want of starting our diagnostic and prognostic operations from their only irrecusable base—the individual norme of the great vital functions. In Europe every traveller or *ouvrier* must have his passport, or livret, bearing his *signalement*, or signs of individuality; but how much more useful signalement would be a livret describing everybody by the signs of his thermometry (general and local), sphygmography, plessimetry, spyrometry, æsthesiometry, etc. Then let any one be sick without help, or simulate sickness, or deny his identity; his *livret* of vital signs—stud-book—or its copy from where it was issued or last

registered would tell of what disorder he is affected—roguery or sickness.

This physiological *passport* ought to be held in honor as the book of nobility in an age of equality: a good physiological record showing more *blood* than does a crooked heraldry. In this order of ideas we rapidly drift.

CHAPTER XI.

FROM MORBID TO HUMAN THERMOMETRY.

LAPLACE said: " *Si l'on considère avec attention la série des objets de même nature, on aperçoit en eux et dans leurs changements des rapports qui se manifestent de plus en plus à mesure qui la série se prolonge, et qui en s'étendant et se géneralisant sans cesse conduisent enfin au principe dont ils derivent.*" This description of the ascension of an idea in the human mind, from its incipience in a point of fact to its crystallization in the form of law, or *principium*, seems to have been given to justify the transition of our idea from morbid to human thermometry. Indeed, being true for one, it is true for all generalizations. Therefore, as we are conscious of this leading power, let us be carried where all ideas come from, and go, to their synthesis.

We have seen the utility of thermometry for the sick, and for those exposed to contagion or infection, or threatened with some form of hereditary or constitutional degeneracy. Let us now consider its usefulness for those interested in the issues of disease, be they a family, a social circle, an industrial group, or a whole nation. Before entering the generalities of the subject, let us report its three last historic illustrations, which bear respectively on: 1st. The power of thermometric indications to warn of a fatal issue; 2d. The positivism of the signs given out by thermometry; 3d. The authenticity of thermography in historic contingencies.

I.—THERMOMETRIC LESSONS.

(*a*) FROM ORLEANS.

" Thermometry warning of fatal issues."

In 1872, a young Duke of Guise died in a religious seminary of Switzerland, from acute meningitis, induced by overstudy.

In 1873, his cousin, a Duke of Montpensier, died of the same disease, brought on by the same cause, in the seminary of the Bishop of Orleans.

The men in charge of these religions and learned haunts pretend to know all the particulars about the hyperpyretic temperatures of one of the next worlds, but do not seem to care about the deadly combustions resulting for their charge from over-work, juvenile exhaustions, etc. Therefore, having neglected the warning of increasing écarts between the morning and evening temperatures of their pupils, they fervently prayed for a miracle, saying: *Les miracles sont la voix de Dieu.*

That is bad enough for the little dukes, but how much worse for peoples; since these men who sent those grandsons of Louis Philippe to heaven—not an unfit place for princes, though—are the same who claim the right of educating all the children, and who invade the school in all countries! In France, to-day, education is at the mercy of this same Bishop of Orleans, M. Dupanloup, who, by his ignorance of the indications of thermometry in education, and particularly of its warnings during the growth-period, wilfully caused the death of his charge, Fernando, Duke de Montpensier.

(*b*) FROM CHISELHURST.

"Importance of electro-thermography."

When Napoleon lay low at Chiselhurst, a wire from his bed to his doctor's desk could have sent thither his thermometry in figures, even in *curves*, the sphygmographic traces of his heart and wrist, besides the other signs of sudden collapse, and in five minutes have returned prescriptions which could have supported life according to rules in such emergencies; instead of which, the physicians in charge used the steam as mean of communication, and when coming to the rescue found him dead.

I do not wet my handkerchief for that; I merely say: by connecting our self-registering instruments to the telegraph, and placing at the other end a paper imbued with millimetric water-lines, we can reproduce from one continent to another the curves of temperature, the movements of a muscle, the flap of the wing of an insect; and when the dying insect is an emperor his last temperatures are good thermometric lessons, to which

Bossuet would have invited an auditorium with his grandiloquent: *Erudimini reges!* . . . .

If I am well-informed, the treatment of Senator Sumner by Brown-Séquard was, for years, conducted through the telegraph. Thus all the progress of art, of mechanism, and of science, must advance hand in hand, as they are represented by noble figures around the chariot of Apollo.

(*c*) FROM SANDRINGHAM.

"Authenticity of thermography in historic eventualities."

When a person of high station becomes sick, so many interests stir about his couch, and bruit interested accounts of the illness, that one of the first wants, from the first hour, is an authentic record of the case.

Never was this want more felt than during the typhoid fever of the Prince of Wales. Yet we simply heard that the Prince was better, worse, recovering, sinking, rallying, convalescing, relapsing, and finally out of danger. For many weeks this was all the news given to an attentive world. The prognosis was as wavering, and seemingly as uncertain as it might have been half a century ago, before thermometry or sphygmography was dreamt of. Naturally, these bulletins, very much resembling those issued from Metz, when France had the misfortune of not losing Louis XV., alias *le bien aimé*, were soon distrusted, and accused of exaggeration, even of falsehood; and openly said to be calculated in view of manufacturing loyalism, even for the vile object of fostering gambling combinations.

That men like Drs. Jenner, Gull, and Lowe, whose scientific reputation is so high, could have exposed themselves, and the medical profession as a body, to such impossible imputations, shows that there was a serious misconception of their duties not to their royal patients, but to the science of medicine, and that, at a time when they had the whole civilized world for an audience.

It seems that the cause of their mistake was the idea that the Majesty of the subject precluded the possibility of publishing the true clinical record of his sickness, as if the disease should behave differently in a prince than in a simple hospital patient. This courtly idea offers the only extenuation for the unscientific character of these bulletins, but is far from find-

ing its justification even in courtly habits and traditions. For these traditions and habits have always been, in case of sickness of a queen, king, or crown-prince, to issue bulletins, as complete as the science of the time could afford, and to keep the royal patient constantly in view of some of the high officers of state.

And why that publicity of sickness and death; why cannot a king agonize quietly; why must peoples prey upon his decomposing form by minute reports and by *de visu* proxies? Evidently because a prince—whatever may otherwise be his individual worth—is a cipher, whose social value is borrowed from the millions standing by him—millions who have never been denied the right to know what becomes of the zero.

Therefore we do not hesitate to affirm that, if the physicians of the Prince of Wales in issuing their bulletins have literally conformed themselves to courtly traditions, in avoiding or neglecting to stamp these bulletins with the seal of modern positivism, they have left the door of their council chamber open to untrue but deserved suspicions; they have neglected a solemn occasion of impressing the people with the precision of the methods of observation which have been substituted for guessing at the bedside; and thereby these eminent physicians have, in no small degree, lowered, or at least prevented, the legitimate rise of the standard of physic in public estimation.

On the contrary, let us for an instant suppose that these eminent men, improving the opportunity actually offered to them by the traditions of all the courts of Europe, would have clothed their bulletins in the scientific form adopted by the medical institutions of London, Paris, Vienna, Berlin, New York; these daily or hourly reports would have been written in a few figures and summed up every septenary. They could also have been accompanied by a few commentaries, such as escape from the lips of a medical man looking at the table of vital signs appended to the bed of an ordinary subject of typhoid fever.

Supposing that these popular and progressive views had prevailed in the judgment of the physicians in charge at Sandringham, the world would have assisted at a novel and dramatic spectacle. We do not mean the spectacle of the pitiable youth slowly eaten up, then let go by the ulceration of his Peyer's glands—we mean the narration, by telegrams, of

the phases of an almost typical case of complicated typhoid fever. Never before would nations have listened to such a tale, mainly told in advance, like a prophecy, by the thermometer; never such interest would have been attached to predictions of better or worse, foreshadowed on the stem of the instrument, and to the degrees of vitality infused in the patient by tonics or food, and written in the pulse-wave of the sphygmograph. Such a medical problem would never before have been solved to a larger or more interested audience: no better opportunity could have been found to prove to the civilized world how much of a science medicine has come to be.

If this mode of bulletins had been adopted—and we firmly believe that Aitken, Sydney Ringer, Wunderlich, Sée, or Jaccoud would have carried it out—what an impulse would that lesson on positive diagnosis have given to the profession; how higher would physic have instantly ranked in the estimation of the public; and, to speak but once like a courtier, what a chance the prince would not have lost of being as useful and celebrated for his sickness as his father was for his goodness! These are some of the lessons we had, and had not, from Sandringham.

CHAPTER XII.

I.—SOCIAL PROGNOSTICATIONS.

Let us take a larger view of our subject. By the comparative study of the concordance and discordance of the three great vital signs, and by the concurrent use of the thermometer, with the sphygmograph, the myograph, the microscope, the æsthesiometer, the dynamometer, and other instruments and methods of positive diagnosis, we have already (Part II., Chapter V., § 1) been enabled to establish several of the mathematical relations of the great functions during their alteration in *plus* and *minus* by disease. Now the *rationale* of the same elements will soon enable us to settle, like mathematical affairs, all questions relating not only to disease, but to vitality, longevity, and adaptability to the various climates, altitudes, longitudes, training, studies, sports, indulgences, labors, individual and social fitness.

I will first remark that thermometry and its adjuncts are of paramount importance in all the interests resting upon the contingencies of life or death. In all important questions men want to know the future; in a state of expectation anything is better than nothing. On the banks of the Cephyse, Niger, Orinoco, Winnipeg, as in the by-streets of London, Paris, New York, the *sac à médecine*, the cards, the sibyl, the gypsy, the turning tables, the bones of St. James, Ste. Rosamonde's tooth, etc., are asked, What next? The educated classes, knowing the trumpery, silence their curiosity or satisfy it in secret, half laughing, half credulous. And it is a pity! Since astronomy succeeded astrology, and chemistry alchemy, as sure as positive diagnosis is slowly but surely taking the place of conjecture and imposture.

It is a pity for which we are responsible. We ought to educate our public to understand the individual, commercial, and

social value of the *predictions* founded upon the signs of health and vitality given out by the physical, chemical, microscopic, and thermometric methods of diagnosis. Their knowledge makes us the exponents of the laws of temperature, physiological dynamics, and affinities; from the observance or dereliction of which we can *predict* the rise or fall of conceited self, of ignorant families, of blind nations. That is our main function in society, besides that one to which we like to confine ourselves, of Sextons of Catalysis. Let us remember: the excellence of the physician is in the prognosis. (Hip. Progn. 1.)

To speak pointedly, I mean to say that our main function is to advise, not only the sick, but those who, being well or apparently well, may become exposed, or protract their exposure to loss of life, or to incapacities, infirmities and failures worse than death by *lysis*, through the crevices open in their vitality by the straining of the exigencies of modern life.

In this part of our profession we claim the whole world for our client. We have the instruments and methods, we must also have the skill to prognosticate in all matters of life and death which are not accidental, but depend on series; to predict for instance, therefore, to prescribe the kind and degree of education and of the various trainings children can stand; the climate and the climatic changes required for their growth and maturation to a healthy virility. In the choice of a life-partner a discrepancy on the tenets of a *credo* were once all-important; now the question of physiological harmonies takes the precedence. In this solemn dilemma the physician can test the power of absorption of one of the parties on the other; for, in a wife, a young man will find rejuvenation—like Antæus each time he touched the ground—or his vitality will be pumped out as by pneumatic suction. For young women, discrepancies of a somewhat different character are still more murderous, whose tests are not the articles of the Nicean creed.

Before young people wed themselves to the world by the choice of a profession, our *meters* must have measured their capacity for outdoor or sedentary occupations, erect or stooping postures, standing or moving-about trade, cerebral or spinal work, etc. Before they plant themselves, and likely their race in a locality, they must be informed about the kind of air, water, soil, vegetation, food, necessary for their prosperity and happiness; since the terrestrial paradise we all look for is not

at a pre-fixed longitude and latitude on earth, but where positive observation teaches us that we can keep at the permanent zero of the physiological thermometer. In these matters physicians must be teachers too.

Indeed, I do not consider them exempt from blame who keep the knowledge of the social value of these positive tests of vitality to themselves until they are urged, in the name of the sick or the dying, to communicate them. Men educated as they now are to be blown up without the sixteenth part of a second warning, must be, methinks, prepared to see without flinching the advance of the signs of their own devitalization, with two compensations—one that the chances of postponing the crisis are offered by him who prognosticating best can prescribe best (Hip. Progn. 2); and the other, of quietly settling the interests of those dear to them, in view of the eventuality of the foretold departure.

But life and death are no more the simple individual phenomena they used to be in mankind, as among the rabbits. The most insignificant unit of the genus (woman or man) cannot disappear without breaking social or financial connections. In this respect the thermometer holds in its tiny stem the fate of mighty interests; let us only consider how fare without it, and how would fare with it, those interests having their origin in life-insurance policies.

II.—The Thermometer for Life Insurance.

The financial guaranties presently offered by the life-insurance companies are considered as very insecure. I know nothing of the accusations published against their officers; but I know that if these smart men were not looking somewhere else for a set-off, most of their concerns would soon break down under the mismanagement of their medical (diagnostic) department: there is the flaw in the life-insurance companies. They have remained profoundly or willingly ignorant of the resources offered them by the recent improvements in vital diagnosis; in the midst of the progress of all trades and industries, few of them have improved the medical guaranties devised for their own security half a century ago; meanwhile the applicants for policies have became more and more crafty in the art of insuring death instead of life.

It is very seldom that a man actually sick asks for the benefit of a policy of insurance (for which *physical diagnosis* would instantly detect his unworthiness); it is, on the contrary, of common occurrence that, as soon as a man feels, or his relatives suspect, that his vital powers are imperceptibly but steadily declining, he becomes an applicant for a policy; the larger, because they know he will not live long enough to pay several annuities. On these cases *physical diagnosis* throws very little light indeed, whilst the instruments of *positive diagnosis* would denounce the fraud with unanswerable evidences.

Two cases which recently came under my observation illustrate the respective situations of the insurer and insured.

A man of sixty-five, after an attack of apoplexy followed by slight paraplegia, had his life insured and died within a year. Another, not over forty, but completely exhausted and worn out, came to me boasting that a company had insured his life, notwithstanding that I had told him that I would not give two cents for it; within six months he had a pneumonia that he had not the vitality to carry to the seventh day. Moral No. 1.—The wives of each respectively pocketed five thousand dollars. Moral No. 2.—In the former case, the sphygmographic traces would have been blunted by senile calcification, and otherwise distorted by the irregularity of the waves of the circulation. In the latter case, thermometry would have shown evening elevations of temperature of more than two degrees; both pathological signs forbidding or invalidating any contract of insurance. In this unequal contest, the managers of the life-insurance companies are said to resort to unfair means, instead of borrowing their protective weapons from *science*, which *always comes to the rescue of those who diligently ask for its assistance.*

The officers of these companies know from long experience, that their great losses do not result from mortality caused by acute diseases, casualties largely provided for; but that they are imposed by comparatively sudden demises due to chronic conditions not diagnosed by their physicians, and not provided for in their calculations. Knowing this, they should soon have learned that the means of physical diagnosis employed by their agents were more appropriate to ascertain actual diseases than to measure the vitality and longevity. A step more in the same line of inquiry would have taught them that the instru-

ments and methods of positive diagnosis, the thermometer, and the study of temperature in particular, offered them the surest guaranties against the dishonesty of their customers.

Who of these smart men would not instantly have introduced thermometry among the means of examining the applicants for a policy, if he had read what Sydney Ringer said in his *Temperature as a Means of Diagnosis*:—"The temperature may be taken as a measure of the amount of tuberculosis and tuberculization, and any fluctuations in it indicate corresponding fluctuations in the severity of the disease. The temperature is a more accurate indication of the amount of tuberculosis and tuberculization than either the *physical signs* or the *symptoms*. By means of the thermometer we can diagnose tuberculosis and tuberculization long before the *physical signs* and *symptoms* are sufficient to justify such diagnosis." And what is more pathognomonic of paralysis, for instance, than a progressive difference in the contractility or tactile sensibility of both sides, as mathematically demonstrated by dynamometry and æsthesiometry? . . . yet who enters these positive signs in the calculation of probabilities of life insurance?

Soon the signs given by the method and instruments of *positive diagnosis* will certainly increase in number, accuracy, value, and importance; but even as they now are, they offer to the life-insurance companies—without excluding other methods of observation—the surest means of fighting successfully the ever-living demon of cheat, and of fairly and successfully managing their own business on a cheaper and more remunerative basis.

But dear as money may be, there are things dearer yet, upon which thermometry and positive diagnosis will be brought to exercise a leading control; among these I name EDUCATION.

III.—THERMOMETRY IN SCHOOLS.

I hope the next progress in education will be such that, before twenty years my veracity will be impugned for saying that in this present month of October, 1875, out of three millions of children entering the schools of our country, not one will be examined in regard to the state of his great vital functions, the harmony of his motor and sensory apparatus on both

sides, the effects of muscular exercise and of mental efforts upon his circulation, respiration, and local and general temperature; and no individual record taken of these, to ascertain the effects of the curriculum upon the further development of the children.

To me the subject is so impressive that I hardly dare to touch it; still I must go on, knowing the while that I cannot expect to do it justice in these few brief paragraphs. Even in my *Report* to the American Government *on the questions of education as represented at the exhibition of Vienna of* 1873, I have not given to that question the prominence it deserves.

During the years children go through their school education, they have to grow too; so willeth Nature. One of the effects of this transitory function of growth is to throw a great disturbance upon the ordinary functions; the more since, by a constant interstitial accretion of neoplasm and new cells, every part changes its actual, and all parts their relative positions in each organ as well as in the whole body. Some children die in this body-quake, and more come out of it bent or crippled, never to rise again in beauty and capacity. But what of those who, meanwhile, have to pass through the ordeal of stupendous studies or stupid immobilities? (See the lesson from Orleans, page 360.) They are superintended and taught by doctors in all the faculties, but they have not yet seen the one whose duty it is to be *the keeper of the ledger of their vital resources.*

Out of the cyclopædia of symptoms which warn against the degenerescence of organs, and the exaggeration or decline of functions in children under training, I will suggest: the daily elevation of general temperature during the latest hours of study; and the following irregularities in the distribution of local temperature—as per surface-thermometer. Extremities cold and body too hot. General coldness, with either dry heat in the palm of the hand, or a cold and abundant moisture of the whole hand. The same general coldness with parched and peeling lips, and inordinate thirst; or localized heats signalized by a flush on one cheek, oftener on one ear, not always on the same side; or an over or unequal temperature on the two temporal regions, marked by a deeper blueness of their venous arborescence. The hand-thermometer and the sight admonish of these dangerous anomalies; the fever and surface-thermometer

measure them, the thermoscope too; and also the pyrogenic action of the elements which enter into the school life.

The body development of the youth is accomplished by oscillations, zoological seasons corresponding, if not in times, in operations at least, with those which regulate the development of vegetables. In one of the springs of these physiological years of children, some of them will undergo remarkable changes, of which note the following:—

They feel all the uneasiness attending growth, and yet they do not grow; but symptoms which cannot be synthetized under the name of a particular sickness lurk about their frame—mark their anorexy and dirt-gray skin. If this state is not closely watched by thermometry, and treated by revolutionary changes of climate, training, food, etc., a secondary fever supervenes, which carries off the child; or receding, leaves bare to view a constitutional affection: this process of degenerescence of a system affects particularly the nervous, lymphatic, and osseous.

In another case the child looks above his fellows in amplitude, freshness, and rich curves; he is amiable though irritable, kind, and studious, but has oftener become tired than can be accounted for. The danger is of a degenerescence of apparatus—of the locomotion, for instance. Whoever has followed with wonder the hasty spring growth of an elder's sprouts, and seen one of them suddenly dry up pithless amidst its sappy fellows, can form an idea of this *degenerescence of special organs by localized deficiency of nutrition.*

This form of localized arrest of nutrition, French *décroit* (Trousseau), popularly *dégras*, is always unilateral, a character which permits us to detect it early, by the comparative use, on both sides, of the instruments of positive diagnosis: of the surface-thermometer, which will detect a coolness of half a degree and upward on the suspected side, long before any other sign of the affection can be otherwise descried; of accurate measurements which will spy the difference of size of the limbs; of electricity and æsthesiometry, delicate tests of tactile sensibility; of the dynamometer which gives mathematical evidences of difference of contractility located in the hands and arms; and of the dynamometric swing, excellent test of that of the lower limbs.

The gravest affections of the nervous systems, central and peripheric, visit the young student in proportion, it seems, to

the severity of his training; and are almost unknown among the young vagabonds and street boys. I intentionally choose these two extremes to show what nutrition is, and what non-nutrition can produce. The college children are better fed than the abandoned children; yet they receive less nutriment from their food because they spend, in mental and other exercises, more of the *pabulum vitæ* than their food—supposing it the best—could afford. To show that this bunkruptcy of nutrition, by inordinate expense of the pabulum, is the cause to which we must refer the majority of the nervous affections I have in view, and their reactions on the rest of the economy, I refer again to one too frequent and too fatal among young scholars—meningitis.

It is in its various forms as complex as the etiology of these forms. However, from the baby who ceases to be nourished, though he is fed, the moment his nurse becomes pregnant, from the child overpowered by heat, and the student by his studies; that the subject be not nourished enough, or spend too much pabulum, the multiform affection—under the symptomatic name of cerebral fever (Trousseau)—may be referred to an insufficiency of the vital properties of the blood, and its causes synthetized in *deficiency of nutrition*—of whatever origin of course.

IV.—Husbanding the Vital Forces.

For there are more ways than one to *starvation*. When we spend more than we can assimilate of forces expressed by caloricity, as in the previous example of the school and vagrant boys; when the blood is not well oxygenated, nor rich in red corpuscles; whenever it does not penetrate all the tissues by circulation and endosmosis; whenever its serum lags behind in its primary form, or in that of lymph, pus, effused fluids, surrounding or not miliary and tuberculous deposits, there is *deficiency of nutrition.*

And as there is a general and a local circulation, there are local as well as general starvations, caused by the devitalized elements of the blood remaining behind in certain localities. If it is cruor, it produces gangrene, dry-rot, etc.; if it is serum, it produces dropsies, tubercular affections, etc. A continuous congestive state (orgasm) disposes to a separation of the com-

ponents of the blood, and to their transformation into secondary products, as much as a prolonged scantiness (anæmia); hence the unrelenting attention exacted from young students makes their meninges the particular seat of vascular congestion, which cannot fail, sooner or later, to end in thickenings and protean formations, which devote the school-laureate to vulgar incapacity, imbecility, or death.

The teacher must know that all the operations exacted from a child—actions, perceptions, emotions, imaginations, thoughts, and volitions—are the direct, reflex, or converted products of sensory and cephalic movements, manifestations of a force.

This *neurine force* is *fed and spent*, *never lost*, but *converted* into labor or *wasted* in shocks and frictions. In regard to this neurine force, those who assume the charge of the youth *will* have twofold duties: one to direct its usage through the muscles, senses, and mind, so that they could produce the most valuable labor with the least friction or shock; the other to keep a constant equilibrium between the forces incoming and those going out. But this duty includes a third, more important than both: it consists in husbanding the nervous and correlating forces, so that the children will have enough, not only to spend in labor, in growth, and in necessary repairs of their organism, but always enough in store to spare for an emergency, like extra work, exposure, disease, surgical accidents, etc. This investment, managed by the true manager of a school, is the real insurance of life and of future capacity; without it, the existence or the welfare of children are never secure.

Therefore, not content with having ascertained their condition at the beginning of each course, we must continue to record their vital signs and the working of their functions periodically for all of them, and more frequently for those whose condition is suspicious. The general thermometer will detect fluctuations (more than diurnal oscillations) in a child too much confined; the local thermometer will descry a line of fever-heat at the base of the forehead in another who overtaxes his memory; the sphygmograph will trace the jerked pulse of one who has been running or boating to excess, or an intermittent one for more secret reasons; the spirometer will show a loss of inspiration which corresponds with a loss of circumference, or with a lateral depression in the chest, as per tape-measure and lead circle; and the dynamometer will mark a weaker con-

tractility otherwise suspected by the circular measurement of the arm and from the loss of body-weight, etc., in the young one's crouching for hours upon books.

This positive knowledge of the organic and functional condition of each child once acquired and steadily kept up, like a commercial account, let the programme of instruction, or even the plan of general training be what they may—dictated for some years yet, but not forever, I hope, by pride and love of the useless—the man in charge of children must in any circumstances manage them upon this physiological basis:

Every animal is a producer of heat, and correspondingly a consumer, too.

He must produce enough of it to live, to grow, to repair its constituent elements, and to move towards its ends, whether man, child, bird, or buffalo (Appendix II.).

The degree of normal production of temperature is the measure of the physiological capacity for action, *alias* latent force.

The first duty of the teacher is to see that there is no useless consumption of this latent force by friction, shocks, etc., as may be ascertained by thermometry.

The second is to supply this force by sufficient food, exercise, aëration, and insolation.

The third is to consume this power in preparing the child for the most useful and congenial modes of activity.

To work—at school or in the fields—the child consumes the organic materials of his blood.

This ustion is the *sine qua non* condition of labor.

The thermometers are the '*meters*' of this local or general ustion, and therefore the index of the capacity of each child for labor.

I most respectfully call the attention of the otherwise so learned and capable superintendents of schools and seminaries towards these principles, the bases of the physiological conditions in which the children must be kept during the entire time, and at the different periods of their tuition and growth.

This must be the object of the earliest reform. The man who understands best the pyrogenic conditions during labor must be the teacher, not only of the pupils, but of the teachers; and will cause to be written in each school-room—but in words invisible for the young: THE CURRICULUM IS MADE FOR THE CHILDREN, NOT THE CHILDREN FOR THE CURRICULUM.

I began this exposition of the application of thermometry and of the instruments and methods of positive diagnosis to the general management of education reluctantly, knowing that I would close it without having room or courage enough to say a tithe of what has so deeply and painfully impressed my own mind and conscience.

I enter more hopefully upon the exposition of the next point, upon which positive diagnosis will be called to exercise a leading control—the use of the thermometer in the management of children by their mothers.

V.—The Thermometer in every Family.

I hardly need say to a mother that the question of temperature takes the precedence over all others in the rearing and breeding of her offspring. She knows that from the first moment, coming out from its liquid atmosphere and its soft surroundings, itself warmer than either, the new-born infant feels our air like a chilly combination of needles and vinegar, in which it loses at once several degrees of temperature—enough to give the ague or kill grown people. This knowledge by sympathy explains how, yet in pains, her first inquiry is if the baby is warm. That is it. That is and will be the main question. Is it warm? . . . Is it too warm? . . . Is it warm enough? . . . Is it equally warm? . . . That is it. She knows more with her feelings than we do with our books. I have only to show her how to make use of her heart-knowledge.

If the body-temperature is the first thing to be considered, the instruments to take it are the second, and the method of appreciating it in health and disease is the third.

To nobody is the thermometric power of the hand so indispensable as to a mother. Happily the hand of woman is generally better educated to feel than that of man; a great superiority, indeed, which compensates for many assumed ones on the other side.

In nursing children, this capacity of the hand to feel—allied to the other delicacies of contact and prehension of which a feeling hand only is capable—is so indispensable, that I cannot understand how those who do not possess these tactile and pre-

hensive delicacies of the hand dare to touch a new-born infant, for fear to break it.

Not that this delicacy of the hand is acquired by our present systems of education: I have seen refined women handle a child with their elaborately softened and bedecked hands as pinchingly as the spider does a fly with her forceps; and rustic women carry it in their clumsy hands as softly as Bouguereau's mothers and sisters.

However, since there is an art in everything, and all baby-nurses are not mothers, I will refer to the directions for the use of the hand-thermometer given on page 255.

If asked when the hand of a mother ought to be used as a thermometer, I answer, without hesitation, always. But not always in the same manner.

With a healthy child the caressing hand is involuntarily inquisitive of any possible abnormal temperature; while, with a puny or convalescent one it is the inquiring hand which is caressing. But in sickness the anxiety of the mind is communicated to the hand, which spends more nervous skill in investigating the temperature than in petting, so that, out of the millions of modes of contacts of the hand of a mother with her child, I have dared to draw tactile categories corresponding to the intensity of purpose of the application of that hand as a thermometer--the necessity of the demonstration was my excuse.

By the same rule, the urgency of using the hand-thermometry begets its frequency as well as its topographic action. With healthy infants it has to be resorted to in the morning before nine, in the afternoon after outside exposure, at bed-time, and one hour or more later, without disturbing the sleep; the survey comprises the head, neck, chest, epigastrium, iliac region, extremities, more carefully the epigastrium the first year, the head (parietal and great fontanella regions) during the teething, the iliac fauces when solid food begins to be greedily and almost toothlessly ingested; the chest when the outside temperature is any way excessive or versatile.

With older children the explorations should be gone through whenever reckless activity, thirst of knowing, indulgence in food or drink, and circumstances to be espied as they occur, give rise to anxiety for any of the important apparatus of the life of relation or nutrition, whereas the investigations will be

particularly directed towards the weak or affected parts in the delicate or the convalescent.

During these more frequent than daily explorations, the hand of the mother has acquired a delicacy of perception which would be desirable in that of physicians, and by which she is made aware of any true, general, or local disturbance of temperature. With the hand alone her knowledge cannot extend farther, she is made sure that *there is a disturbance;* but it is only with her two medical thermometers that she can, in five minutes, gauge the *extent* and *intensity* of the abnormal ustion.

Here ends her part as a pre-diagnostician.

[I must say to her incidentally, that with young children much contention is avoided by introducing the fever thermometer in the axilla from behind.]

As soon as she has recognized the presence of a pyretic affection by a sudden rise of 2°–3°, or a steady one from 1°–2° with fluctuations, or that of an apyretic affection by a fall of more than 1°, of which she must carefully note the degrees and fractions at stated times, the first part of her work is ended; she has to transfer her responsibility to the physician she knows most competent to bear it; here her independent action ceases, and my direct advice to her also.

Every physician is alive to the importance of good nursing. No pains, I have repeated after competent authorities, must be spared to form competent nurses. But when the mother is also the nurse, we owe more to her, who works with us for love, than to strangers, who work under us as a trade. It is my opinion she has a right to know all that she can understand (I purposely restrict this remark to thermometry) on the manœuvre and use of the surface and fever thermometers; and their application to the present case; on the recording and significance of their reading; on the relations of human temperature with health, disease, and therapeutics; and on the general philosophy of thermometry, as far as her mind can go.

This is not all. Make her love, study, and trust the little magician who, like the little finger in the fairy tale, tells things that nobody can know otherwise. With it she will give us a trusty account of the condition of her patient. During our absence, her hand will be our hand, her eye our eye; and more, seeing a sudden rise or fall of temperature when we are

away, she foresees the peril that thermometry predicts several hours in advance, as the barometer does the storm; her mind becomes our mind, she hastens our return, giving us a chance to ward off a deadly exacerbation or collapse; truly herself saving the life of the patient and eventually our own reputation.

Therefore let us educate women in the arts secondary to ours, and particularly in the handling, recording, and intelligent reading of the operations of the medical thermometers. And when the hours of family trials and of heavy professional responsibilities come, when zymotic or contagious diseases invade the home circle, we have by our side the faithful woman. Neighbors, quacks, and mediums proffer in vain their nostrums; she stands by her thermometer, knowing that a calm and correct record of a day's fever brings more hopes and is a better foundation for a cure than a dishevelled therapeusis. (More details can be found in the little *Manual of thermometry for mothers, nurses, teachers, etc.*)

Less solemn, but not less useful, is the prophylactic home-use of the medical thermometers. I can only give one instance of it: when parents are preparing for an absence, the husband looks at his weather-thermometer to provide extra coverings against the rigors of external temperature, and the mother looks to her medical thermometers to make sure that she does not leave behind, ignored, a bodily temperature foreboding sickness to one of the children in the next twenty or forty hours.

VI.—Family Health Records.

But mothers, teachers, and physicians as well, need a standard-measure upon which to proportion their action on the young, the sick, the invalid. That standard-measure which we have not and must have, will be found in a Stud-Book or Health Record from infancy. This would be broader in its scope than the Prescription and Clinic Record, previously described, which could conveniently be included in it; if it was not better to leave the Health Record under the charge of the mother, among the private papers of a family, and the Prescription and Clinic Record in the pocket of the physician.

The Health Record would begin, if possible, by the condi-

tions of gestation, birth, nursing, teething, with inter-current illnesses. Note the time at which the muscular and sensory functions have begun to obey the will and to be co-ordinated; at which the mind passed from the simple perceptive to the duplex reflective state. This done once for all, and as a basis, the record would register every year, better every season, the general growth and weight, the length and breadth of the principal parts, head, chest, etc. It would be particularly devoted to the keeping of the vital signs as aforesaid; of the progress of muscular contractility; of general and special sensibility as given by physical tests and by positive mensurations, and most particularly to the concordance and discordance of the signs furnished by the circulation, the respiration, and the temperature. Let us observe, in reference to the latter, that if it be true that the general temperature in health varies but a few tenths, it is not indifferent to know how these variations, ever so small, are brought on; for, if by powerful emotional or circumstantial causes, this shows a constitution eventually capable of reaction against catalytic agencies; but, if by slight causes, we must be prepared to find the subject in ulterior sicknesses, without much power of resistance to the morbid process, or reaction towards recovery; in this latter case, a trifling loss of a few tenths of a degree of heat is portentous.

Another order of pyrogenic facts, whose data in health, if properly recorded, insure the ulterior formation of sound medical and educational diagnosis, is that given by the surface-thermometers. The data thus furnished refer to the average heat of regions like the head, chest, palm of the hands, and comparatively of the feet, of the epigastrium, etc., in the various seasons and under the action of food, exercises, studies, sports, etc.; data of local thermometry which are to be industriously compared with those of general thermometry, of the pulse strokes, sphygmographic waves, spirometric indications, etc.

Another order of pyrogenic facts of great practical value is the one resulting from the application of the thermoscope to the demonstration of the quantity of radiated heat, and of the velocity of this radiation.

By the concurrent reading and interpretation of these facts, carefully prepared and registered by the mother, teacher, or family physician, the latter cannot fail to foresee a long way

off, in any or several functional disturbances, the coming organic accident, and to stamp it out.

Who of us has not been seized by a feeling like that of giving up at the sight of patients, mostly children, whose enigmatical symptoms cannot be illumined, neither by the unconscious patient nor by the ignorant family? Then twelve lines of records of vital signs, each depicting one year of life, would clear up the dark past, and light up the prognosis and treatment; and thereby, also, how many diseases could be prevented. Families would not be slow to perceive what a saving of time, money, suffering, and lives this Record of Health could afford, and would soon beg their physician to begin his practice with them where it really begins, at the taking of all the details of the physiological diagnosis as a standard-measure of the gravity of ulterior pathological symptoms.

§ VII.—Co-ordination of the Plan.

(*a.*)—of the labors of the practitioner.

What a practising physician wants after—but no less than—an *ab initio* family record is a record of the present medical constitution and medical doings in his surrounding. The county, state, and general medical societies are well organized to form such timely records; only they do not, for the simple reason that none bring to their meetings the elements of the needed information.

Reports on general questions are rarely made; the last we had, at the New York Medical Library Association, from Dr. Marie Putnam-Jacobi, on *The Progress of therapeutics during last year*, was deservedly appreciated; but what the isolated practitioner needs—if not more—oftener than generalities, are these summings-up of the medical actualities which force his mind to *co-ordinate* his individual experience to that of his medical brethren. If he gives nothing, he receives the same; conversely, the mites of each form the loaf of all.

A summary somewhat in the shape of the following one ought to be given by every physician to the secretary of his medical society; and the collection of these monthly reports would reverberate the light of experience when and where it is most needed.

NOSOGRAPHICAL SUMMARY.

Prevalent Diseases.	No.	Duration. Min.	Max.	Aver.	Cures.	Death.	Treatment and Remarks.

(*b.*)—CO-ORDINATION OF THE MEANS OF UNIFORM OBSERVATION.

A word more to bind together these apparently isolated suggestions.

The creation of a thermometric scale starting from the physiological temperature of man, zero-health, up to mark fever, exacerbation, etc., down to mark depression, collapse, etc.

The invention (1) of a surface-thermometer to measure by comparison local pyrexias, as the fever-thermometer measures general temperatures, and particularly susceptible to demonstrate the differences of temperature of the temporal region caused by mental work, concussions, bursts of passion, etc.; (2) of the thermoscope to measure the loss of body-heat by the velocity of its radiation.

The arrangement of a *Prescription and Clinic Record*, to register the data of thermometry, and of other important methods of diagnosis in the shortest possible time, and whose simplicity and uniformity of plan permit any physician to compare his clinical notes with each other, and with those of his confrères, upon any given subject.

The formation of *new tables of temperature* and of other vital signs, which require no drawing skill; on which can be grouped all the clinical matters by days and weeks: the latter

arrangement by septenaries, offering the much needed opportunity of definitively testing the old doctrine of the *Crises and Critical Days.*

The new era open to therapeutics by the power of the thermometer of mathematically measuring the calorific and frigorific action of medicines.

The method of using thermometry and other means of positive diagnosis to predict the extent of capacities for labors of various kinds, the degree of vitality, and the chances of longevity of people who want to enter any active career, and to give or receive guaranties dependent upon their capacity or longevity.

The transfer of the management and training of children to those who know how to husband their vitality expressed by their caloricity.

The value of thermometry in the hands of mothers to predict diseases or relapses, to help the physician in the management of the sick, and to protect herself against the assailing suggestions of the ignorant or of the designing, who hover around a sick-bed like ravens above a corpse.

The necessity for physic, not only to be one of the physical sciences, but to show itself such, by the scientific concordance of its *Records*, which permit any physician to read, criticise, compare, even to continue any observation, or group of observations pertaining to the practice of a confrère, or to the philosophy of his art, as do physicists and mathematicians.

These suggestions, once brought together by simple apposition, must already appear what they really were—the intentional parts of an intended plan: the segments of an intellectual cycle.

The segments are the means I have suggested, and the new ones which will soon be offered by other observers to enforce their cohesion.

The cycle is the *ensemble* of the means of substituting positivism for conjecture, authority and credulity in the management of health, disease, education, human solidarity, and social progression.

The key to this cycle could not have been the microscope, notwithstanding its wonders; because its data are not always positive, and it is, so far, too exclusively engaged in analytical investigations; it is the thermometer, which has shown an equal

adaptability to the industry of analysis in individual observation, and to the genius of synthesis in the formation of important *entities* by the creation of several laws of diseases, but from which much more is expected.

Thermometry will find new laws of disease, new relations of temperature to the various modes of vitality, new standards of observation, and new means of communicating them among physicians. It will extirpate quackery, whose ways cannot stand the light of positive observation, particularly if we give it a scientific and readable unity among ourselves, and if we communicate its rationale to our clients. It will protect legitimate interests founded on vitality, whose claims can be authenticated by means of the instruments of positive diagnosis; it will, in particular, rule the question of Life Insurance.

By keeping a correct record of the phenomena of life in each child, thermometry will take the lead in the management of youth, and particularly in that of general education, assuming as the basis of all the modes and phases of the training, the indications of the temperature and of the other vital signs, instead of the arbitrary pretensions of literary, scientific, or religious curriculums. The application to practical education of the tests offered by thermometry, and by the other means of positive diagnosis, will keep constantly the balance of vitality in favor of the students, thereby improving their beauty and capacity, and soon the æsthetic, social, and working qualities of the race. Here thermometry, as I promised it would, without ceasing to be *medical*, becomes *human;* the thermometer opens the way to the most positive application of physiology to the solution of the problems of education; and the prophecy of Descartes will be fulfilled: *if it is possible to improve mankind, physic will give us the means thereof.*

At this point I cannot say a word more. Not in vain will this great Seer have traced our future. He gave us the objective, we acquired the means of attaining it. To organize these means in a working unity is to organize victory over fatal degenerescence.

We owe our art to co-ordinate the means by which physic will take its rank among the natural sciences.

We owe our profession the use of uniform instruments, scales, methods of observation, and common modes of communicating among ourselves ideas, observations, and discoveries.

We owe each individual a statement of his *status* in regards to heredity, health, moral and physiological dynamics: a stud-book not refused to a horse, often granted to a pig.

We owe a clear exposition of our principles, most particularly to mothers, too long left, by our pride or levity, ignorant of the naturalness of diseases, which have their laws; and credulous to the supernaturalist, who assumes towards them the atheistic power of infringing the natural laws in matters of cure or death.

We owe to society all what we know of our art, since it is no more an arcanum but an heirdom, the property of all who can understand it, and help us in its application.

We owe to the progress of our species to study, and to apply in our limits, the laws and means by which our race will attain and maintain the highest degree of health, proficiency, and happiness, inherent to the preservation of the physiological temperature: *mens sana in corpore sano.*

VIII.—Conclusion.

Looking back to the preceding pages, I see the proportions of the responsibility I have incurred, yet do not propose to take advantage of the attenuating circumstances; whatever could be the verdict, I plead guilty. At the end of a patient exposition of what thermometry has done in the last thirty years, by its highest interpreters, I have attempted to foreshadow what it will accomplish in the next twenty.

What I believe to be true I have worked to make it real. Though I began long ago, I never did more for the honor of the art, whose practice honored me, than since I came into my sixties. I have developed several points of this philosophy of medicine two years in succession before the British Medical Association and the French Association for the Advancement of Sciences, and oftener before the New York State and the American Medical Association; and I did it each time—without regard to personal inconvenience—with a decided opinion of my individual deficiencies; but with a no less firm confidence in the strength of the cause. I have given it all that the young offers for the possession of his ideal, and the old for the realization of his idea.

Human thermometry, though of recent origin, is already much more directly useful to man than the climatic. The two principal obstacles to its propagation were: 1st. The diversity of its instruments, whose various centres (zeros) are away from the scale of the living; far from the figures looked for in vital problems. 2d. The keeping of thermometric accounts in graphics, which need the hand of an artist, and must be reconverted in figures to be serviceable in practice. These causes excluded clinical thermometry from many hospitals, from almost all private practice, from the nursery, the school, etc.

The physiological thermometer, having its zero at the health point, can be understood by all; and the mathematical thermography being written in plain figures, can be read as easily.

Thus rendered HUMAN, thermometry protects the life of children and invalids, as well as of the sick; guides and justifies the physician; enfranchises mothers from the imposition of the bonzes; reconstitutes the antique unity of diagnosis around the phenomena of ustion; and connects the laws of animal heat—as far as they are discovered—with the known laws of the universe.

That is the idea to which I gave my last years. (See Appendix XXII.)

I spent my youth in demonstrating that idiots can be improved, and that—from the comparative study of their infirmities with the means of making them perceive, think, etc.—there would result a *Physiological Method of Education*, by which mankind could be improved. Having lived long enough to witness the initial success of this first idea, I confidently expect—though I may not see—the proximate success of the second: ideas cannot perish, but after having accomplished their evolution. In this persuasion my last word is:—Thermometry begat thermography, and thermography is pregnant with medical mathematism.

APPENDIXES.

APPENDIX I.

TABLE OF EQUIVALENTS OF THE CELSIAN (CENTIGRADE), RÉAUMUR'S, FAHRENHEIT'S, AND PHYSIOLOGICAL THERMOMETERS.

To convert Centigrade into Fahrenheit, multiply by 9, divide by 5, and add 32; or, multiply by 1.8 and add 32.
EXAMPLE:—20° × 1.8 + 32 = 68° F.

To convert Centigrade into Réaumur, multiply by 4, and divide by 5; or, multiply by 0.8
EXAMPLE:—20° C. × 0.8 = 16° R.

To turn Fahrenheit into Centigrade, deduct 32, multiply by 5, and divide by 9.
EXAMPLE:—104° F. − 32 × 5 ÷ 9 = 40° C.

To turn Fahrenheit into Réaumur, deduct 32, divide by 9, and multiply by 4.
EXAMPLE:—104° F. − 32 ÷ 9 × 4 = 32 R.

To turn Réaumur into Fahrenheit, multiply by 9, divide by 4, and add 32.
To turn Réaumur into Centigrade, multiply by 5, and divide by 4.
To convert Fahrenheit or Réaumur into the Physiological Scale, or *vice versâ*, reduce them to Centigrade. From Centigrade to Physiological the difference of 37° can always be made cursorily in the mind without formal operation.

Fahrenheit.	Réaumur.	Celsius (Centigrade).	Physiological.	Fahrenheit.	Réaumur.	Celsius (Centigrade).	Physiological.
32	0	0	$\overline{37}$	83.4	22.4	28	$\overline{9}$
41	4	5	$\overline{32}$	85.2	23.2	29	$\overline{8}$
50	8	10	$\overline{27}$	86	24	30	$\overline{7}$
59	12	15	$\overline{22}$	86.9	24.4	30.5	$\overline{6}.5$
63.5	14	17.5	$\overline{19}.5$	87.8	24.8	31	$\overline{6}$
68	16	20	$\overline{17}$	88.7	25.2	31.5	$\overline{5}.5$
69.8	16.8	21	$\overline{16}$	89.6	25.6	32	$\overline{5}$
72 5	18	22.5	$\overline{14}.5$	90.5	26	32.5	$\overline{4}.5$
73.4	18.4	23	$\overline{14}$	90.68	26.08	32.6	$\overline{4}.4$
75.2	19.2	24	$\overline{13}$	90 86	26.16	32.7	$\overline{4}.3$
77	20	25	$\overline{12}$	91.04	26.24	32.8	$\overline{4}.2$
79.8	20.6	26	$\overline{11}$	91.22	26.32	32.9	$\overline{4}.1$
81.5	22	27.5	$\overline{9}.5$	91.40	26.4	33	$\overline{4}$

Fahrenheit.	Réaumur.	Celsius (Centigrade).	Physiological.	Fahrenheit.	Réaumur.	Celsius (Centigrade).	Physiological.
91.58	26.48	33.1	$\bar{3}.9$	98.24	29.44	36.8	$.\bar{2}$
91.76	26.56	33.2	$\bar{3}.8$	98.42	29.52	36.9	$.\bar{1}$
91.94	26.64	33.3	$\bar{3}.7$	98.60	29.60	37	0
92.12	26.72	33.4	$\bar{3}.6$	98.78	29.68	37.1	$.\underline{1}$
92.30	26.80	33.5	$\bar{3}.5$	98.96	29.76	37.2	$.\underline{2}$
92.48	26.88	33.6	$\bar{3}.4$	99.05	29.80	37.25	$.\underline{25}$
92.66	26.96	33.7	$\bar{3}.3$	99.14	29.84	37.3	$.\underline{3}$
92.84	27.4	33.8	$\bar{3}.2$	99.32	29.92	37.4	$.\underline{4}$
93.02	27.12	33.9	$\bar{3}.1$	99.50	30	37.5	$.\underline{5}$
93.20	27.20	34	$\bar{3}$	99.68	30.08	37.6	$.\underline{6}$
93.38	27.28	34.1	$\bar{2}.9$	99.86	30.16	37.7	$.\underline{7}$
93.56	27.36	34.2	$\bar{2}.8$	99.95	30.20	37.75	$.\underline{75}$
93.74	27.44	34.3	$\bar{2}.7$	100.4	30.24	37.8	$.\underline{8}$
93.92	27.52	34.4	$\bar{2}.6$	100.22	30.32	37.9	$.\underline{9}$
94.10	27.60	34.5	$\bar{2}.5$	100.40	30.40	38	$\underline{1}$
94.28	27.68	34.6	$\bar{2}.4$	100.58	30.48	38.1	$\underline{1}.1$
94.46	27.76	34.7	$\bar{2}.3$	100.67	30.52	38.15	$\underline{1}.15$
94.64	27.84	34.8	$\bar{2}.2$	100.76	30.56	38.2	$\underline{1}.20$
94.82	27.92	34.9	$\bar{2}.1$	100.85	30.60	38.25	$\underline{1}.25$
95	28	35	$\bar{2}$	100.94	30.64	38.3	$\underline{1}.3$
95.18	28.8	35.1	$\bar{1}.9$	101.12	30.72	38.4	$\underline{1}.4$
95.36	28.16	35.2	$\bar{1}.8$	101.30	30.80	38.5	$\underline{1}.5$
95.54	28.24	35.3	$\bar{1}.7$	101.48	30.88	38.6	$\underline{1}.6$
95.72	28.32	35.4	$\bar{1}.6$	101.66	30.96	38.7	$\underline{1}.7$
95.90	28.40	35.5	$\bar{1}.5$	101.75	31	38.75	$\underline{1}.75$
96.08	28.48	35.6	$\bar{1}.4$	101.84	31.4	38.8	$\underline{1}.8$
96.26	28.56	35.7	$\bar{1}.3$	102.02	31.12	38.9	$\underline{1}.9$
96.44	28.64	35.8	$\bar{1}.2$	102.20	31.20	39	$\underline{2}$
96.62	28.72	35.9	$\bar{1}.1$	102.38	31.28	39.1	$\underline{2}.1$
96.80	28.80	36	$\bar{1}$	102.56	31.36	39.2	$\underline{2}.2$
96.98	28.88	36.1	$.\bar{9}$	102.65	31.40	39.25	$\underline{2}.25$
97.16	28.96	36.2	$.\bar{8}$	102.74	31.44	39.3	$\underline{2}.3$
97.25	29	36.25	$.\overline{75}$	102.875	31.48	39.35	$\underline{2}.35$
97.34	29.4	36.3	$.\bar{7}$	102.92	31.52	39.4	$\underline{2}.4$
97.52	29.12	36.4	$.\bar{6}$	103.10	31.60	39.5	$\underline{2}.5$
97.70	29.20	36.5	$.\bar{5}$	103.28	31.68	39.6	$\underline{2}.6$
97.88	29.28	36.6	$.\bar{4}$	103.46	31.76	39.7	$\underline{2}.7$
98.06	29.36	36.7	$.\bar{3}$	103.55	31.80	39.75	$\underline{2}.75$
98.15	29.40	36.75	$.\overline{25}$	103.64	31.84	39.8	$\underline{2}.8$

Fahrenheit.	Réaumur.	Celsius (Centigrade).	Physiological.	Fahrenheit.	Réaumur.	Celsius (Centigrade).	Physiological.
103.82	31.92	39.9	2.9	108.725	34.1	42.625	5.625
104	32	40	3	108.86	34.16	42.7	5.7
104.18	32.08	40.1	3.1	108.95	34.20	42.75	5.75
104.36	32.16	40.2	3.2	109.04	34.24	42.8	5.8
104.45	32.20	40.25	3.25	109.175	34.3	42.875	5.875
104.54	32.24	40.3	3.3	109.22	34.32	42.9	5.9
104.72	32.32	40.4	3.4	109.40	34.4	43	6
104.90	32.40	40.5	3.5	109.58	34.48	43.1	6.1
105.108	32.48	40 6	3.6	109.625	34.5	43.125	6.125
105.125	32.52	40.625	3.625	109.76	34.56	43.2	6.2
105.26	32.56	40.7	3.7	109.85	34.6	43.25	6.25
105.37	32.60	40.75	3.75	109.94	34.64	43.3	6.3
105.44	32.64	40.8	3.8	110.075	34.7	43.375	6.375
105.62	32.72	40.9	3.9	110.12	34.72	43.4	6.4
105.80	32.80.	41	4	110.30	34.8	43.5	6.5
105.98	32.88	41.1	4.1	110.48	34.88	43.6	6.6
106.025	32.92	41.125	4.125	110.525	34.9	43.625	6.625
106.16	32.96	41.2	4.2	110.66	34.96	43.7	6.7
106.25	33	41.25	4.25	110.75	35	43.75	6.75
106.34	33.04	41.3	4.3	110.84	35.04	43.8	6.8
106.52	33.12	41.4	4.4	111.02	35.12	43.9	6.9
106.70	33.20	41.5	4.5	111.20	35.20	44	7
106.88	33.28	41.6	4.6	111.38	35.28	44.1	7.1
106.925	33.32	41.625	4.625	111.56	35.36	44.2	7.2
107.06	33.36	41.7	4.7	111.74	35.44	44.3	7.3
107.15	33.40	41.75	4.75	111.875	35.5	44.375	7.375
107.24	33.44	41.8	4.8	111.92	35.52	44.4	7.4
107.375	33.50	41.825	4.825	112.1	35.6	44.5	7.5
107.42	33.52	41.9	4.9	112.28	35.68	44.6	7.6
107.60	33.60	42	5	112.46	35.76	44.7	7.7
107.78	33.68	42.1	5.1	112.64	35.84	44.8	7.8
107.825	33.70	42.125	5.125	112.82	35.92	44.9	7.9
107.96	33.76	42.2	5.2	113	36	45	8
108.05	33.80	42.25	5.25	114.8	36.8	46	9
108.14	33.84	42.3	5.3	116.6	37.6	47	10
108.185	33.90	42.375	5.375	118.4	38.4	48	11
108.32	33.92	42.4	5.4	120.2	39.2	49	12
108.05	34	42.5	5.5	122	40	50	13
108.68	34.08	42.6	5.6				

APPENDIX II.

NOTE ON THE HEAT PRODUCED BY ANIMALS, AND THEIR RESISTANCE TO ATMOSPHERIC DIFFERENCES OF TEMPERATURE.

We have seen the fœtus warmer than its mother. All animals have, like man, their normal temperature, capable of resisting the action of external heat or cold. Here are subjoined, from Gavarret, Valentin, etc., tables of temperature of different classes and species of animals, showing that their degree of resistance to cold is very much in proportion to the perfection of their organization. This reminds us that the vital laws have not been made for man separately from animals. The law of resistance of animals to their ambient atmosphere applies to man mainly in this, that he too cannot evolve more heat than is shown by his norme without endangering his life. This is said for teachers as well as for physicians. The temperature of man oscillates between 36.50° and 37.50°; averages 37°. A sudden *change* of 5°, or a steady *loss* of .5° are equally incompatible with life.

a.—Tables of Temperature of Birds.

	° Cent.
Petrel	40.30–40.80
Parrot	41.10
Goose	41.70
Jackdaw	42.10
Screech-owl	41.47
Heron	41.
Sparrow	41.67–42.10
Yellow Hammer	42.88
Tiercelet	41.47
Pigeon	41.80–43.30
Cock	39.44–40.
Turkey-cock	42.70
Moor-hen	42.00–42.50
Guinea Fowl	43.90
Common Fowl	39.44–43.90
Thrush	42.80
Common Duck	42.50–43.90
Crow	41.17
Raven	42.91

b.—The Temperature of Mammifers.

	° Cent.
French Horse	36.80
Arabian Horse	37.50
Common Rat	38.80
Common Hare	37.80
Tiger	37.20
Common Cat	38.30–38.90
Squirrel	38.80
Panther	38.90
Dog	37.40–39.60
Elk (female)	39.40
Monkey	35.50–39.70
Sheep	37.30–40.50

	° Cent.
Ichneumon	39.40
She-goat	40.
He-goat (castrated)	39.50
She-ass	37.98
He-ass	37.95
Jackal	38.50
Ox	37.50
Capibara	35.76–39.
Rabbit	37.50–40.
Porpoise	35.62–37.80
Sea-cow	38.89-40.

c.—Excess of Temperature of Reptiles over that of their Surrounding Atmosphere.

	° Cent.
Viper	5.06
Toad	0.50–2.80
Frog	0.04–4.44
Iguan	1.22
Boa	2.50
Lizard	0.75–1.25
Adder	1.35–3.90
Turtle	1.22–3.90

d.—Excess of Temperature of Fishes over that of their Surrounding Atmosphere.

	° Cent.
Pike	3.88
Carp	0.36–3.
Eel	0.93
Tench	0.50–0.71
Shark	1.30
Trout	0.55–1.10
Ablet	0.55
Perch	0.52

e.—Excess of Temperature of Articulata and Annelides over that of their Surrounding Atmosphere.

	° Cent.
Beetles	0.25–0.70
Glow-worm	0.50
Ground-worm	1.11-1.39
Silk-worm	1.
Larvæ of Sphinx	1.66
Coccinella	0.44
Gryllus	0.31–0.94
Scarabæus Vernalis	0.12–0.18
Leech	0.56–0.85

f.—Excess of Temperature in Lower Animals over that of their Surrounding Atmosphere.

	° Cent.
Crustacea	0.60
Cephalopods	0.57

	° Cent.
Molluscs	0.46
Echinoderms	0.40
Meduses	0.27
Polyps	0.21

APPENDIX III.

DIURNAL OSCILLATIONS.

(*a*.)—Dr. Ogle's observations were made in the St. George Hospital, by day in summer, by night in winter, and lasted many months. The average daily variation was $\frac{5}{6}$° C.=1½° F. The minimum, a winter's morning, at 5.30 A.M., was 36.1 C.= 97° F., and the maximum 38.25° C.=100.6° F., in a Turkish bath. (Temperature taken under the tongue.) Means of monthly results:

Time of the day.	Male.	Female.
9—11 A.M. before breakfast	97.73°	98°
11 A.M.—2 P.M	98.2°	98.56
3—5 P.M.; lunch at 3 P.M	98.36°	98.57
6.30 P.M.—7.30 P.M.; dinner at 7 P.M.	98.63°	98.6°
9 P.M.—10 P.M.	98°	98.45°
12 M.—12.30 P.M	97.96°	98°
12.30 A.M.—1 A.M; bed at 1 A.M	97.9°	No observation taken of females during the night.
3 A.M.—5 A.M	97.5°	
5.30 A.M.—6.30 A.M	97.2°	
8 A.M.—9 A.M	97.66°	

(*b*.)—Alveranga extended similar observations to two hundred and eighty persons, whose ages varied from nine to sixty-five years, and who took their meals at eight, one, and seven o'clock:

Hours of Observation.	Temperatures.			
	Maxima.	Minima.	Media.	General Average.
5 o'clock A.M	37.5°	36.0°	36.81°	37.27°
7 " "	37.6°	36.3°	37.04°	
9 " "	37.8°	38.8°	37.32°	
10 " "	37.9°	36.6°	37.35°	
11 " "	37.9°	36.6°	37.36°	
2 " P.M	37.9°	36.7°	37.42°	
4 " "	37.9°	36.6°	37.42°	
8 " "	37.9°	36.6°	37.36°	

(c.) Bärensprung gives the results of his observation of temperatures (a) at stated hours, (b) and after meals; a compound cause for oscillation:

Morning, before breakfast, between 5 and 7 o'clock	36.69°
Morning, after breakfast, between 7 and 9 o'clock	37.19°
Before noon, between 9 and 11 o'clock	37.26°
Before dinner, between 1 and 2 o'clock	36.84°
After dinner, between 2 and 4 o'clock	37.16°
Afternoon, between 4 and 6 o'clock	37.49°
Early evening, between 6 and 8 o'clock	37.44°
After supper, between 8 and 10 o'clock	37.03°
Before going to bed, between 10 and 12 P.M.	37.35°
Being abed, between 12 and 2 A.M.	36.65°
In bed, between 2 and 4 A.M	36.31°
Difference between extreme minima and maxima	1.18°

Comparing among themselves these figures, we remark that the heat-producing power of food is less in the two first hours than in the two following ones, and that cooling begins from four to six hours after meals. Compare also these figures with those of Dr. W. Squire, who found the heat to begin sooner, and to attain quicker much higher figures in infants than in adults (see Temperature in Infancy).

APPENDIX IV.

MIGNOT'S TABLE OF PROPORTION OF TEMPERATURE, PULSE, AND RESPIRATION IN FOURTEEN CHILDREN FROM THREE TO SEVEN DAYS OLD.

(*The temperature of the room was* 15°—16°.)

Number of Cases.	Age.	Sex.	Constitution.	Temperature (under the Axilla).	Pulse.	Respiration.
I	5 days.	Male.	Strong.	37.7°	132	48
II	4 "	Female.	Sickly.	37.3°	112	38
III	5 "	Male.	Feeble.	37.5°	108	24
IV	4 "	"	"	37.8°	120	48
V	5 "	"	Strong.	38.0°	120	28
VI	4 "	"	Feeble.	36.8°	132	30
VII	4 "	"	Medium.	38.1°	120	36
VIII	7 "	Female.	Strong	37.4°	132	36
IX	3 "	"	"	37.5°	120	33
X	5 "	"	Feeble.	37.9°	134	38
XI	5 "	"	Strong.	38.0°	132	—
XII	3 "	Male.	"	37.9°	132	—
XIII	4 "	Female.	"	37.6°	—	—
XIV	5 "	Male.	"	37.8°	132	42

APPENDIX V.

(The reasons why we will give more tabulated temperatures from Roger than from any other are contained in this appreciation of W. Squire, of London: "These figures have been unintentionally verified in the course of inquiries made independently and in ignorance of the good work there extant.")

(*a.*)—ROGER'S TABLE OF COMPARATIVE TEMPERATURE OF MOTHER AND CHILD AT BIRTH.

Age.	Number of Respirations.	Number of Pulsations.	Axillary Temperature of the Infant.	Axillary Temperature of the Mother.*
1 minute..........	50	....	37.75°	36.75°
"	34	110	36.75°	36.25°
3 to 4 minutes.....	39	105	36°	37°
5 to 30 minutes....	68	120	37°	37°
" "	36	132	36°	37°
" "	60	96	35.50°	37°
" "	60	96	35.50°	37°
" "	28	130	35.50°	36°
" "	22	65	35.25°	37°

This table gives the following—

	Maxima.	Minima.	Averages.
Of temperature......................	38.1°	36.8°	37.45°
Of pulse............................	134	108	$117\frac{5}{13}$
Of respiration......................	48	24	$36\frac{5}{11}$

(*b.*)—What can be inferred from the comparison of the temperature, pulse, and respiration of the two sexes.

Boys.			Girls.		
Temperature.	Pulse.	Breath.	Temperature.	Pulse.	Breath.
37.7°	132	48	37.3°	112	38
37.5°	108	24	37.4°	132	36
37.8°	120	48	37.5°	120	33
38°	120	28	37.9°	134	38
36.8°	132	30	38°	132	—
38.1°	120	36	37.6°	—	—
37.9°	132	—	——	—	—
37.8°	132	42	——	—	—
Total... 301.6°	996	256	Total... 225.5°	630	145
Average. 37.7	122	$36\frac{4}{7}$	Average. $37.6\frac{4}{7}$	126	$36\frac{1}{4}$

* We would suggest that the mother having just had the worse opportunities for keeping her axilla well shut up and warm (as a natural cavity), the best place to take her temperature at this juncture would be the vagina, and correspondingly, that of the baby, the rectum.

(*c.*)—Pretty close contest, since—

The temperature average for boys was	37.7°
" " girls was	37.6°
" total for boys was	301.6°
" " girls was	307.7°
The pulse average for boys was	122
" " girls was	126
" total for boys was	996
" " girls was	1,008
The respiration average for boys was	$36\frac{1}{7}$
" " girls was	$36\frac{1}{4}$
" total for boys was	292.5
" " girls was	290

So that the total temperature of the eight boys is above that of the same number of girls by .9° (less than a degree).

The total of pulse of the girls over the boys is but 12 beats.

And the total of respiration of the boys is more frequent than that of the girls by 2.5 breathings.

This small piece of statistics is not likely to solve the pending problem of the superiority of either sex.

APPENDIX VI.

(*a.*)—BÄRENSPRUNG'S TABLE OF TEMPERATURE OF THE DIFFERENT AGES.

At birth	37.08°
A few hours after	36.95°
During the first ten days	37.55°
To puberty	37.63°
From 15 to 20 years	37.39°
" 21 to 30 "	37.08°
" 31 to 40 "	37.11°
" 41 to 50 "	36 94°
" 61 to 70 "	37.09°
At 80	37.16°

This table shows the average temperature of infancy 37.30°; of youth and virility, 37.39°; of old age, 37.04°; of senility, 37.17° C.

(b.)—ROGER'S TABLE OF TEMPERATURE, PULSE, AND RESPIRATION OF THIRTY-THREE CHILDREN FROM ONE TO SEVEN DAYS OLD.

Days.	Sex.	Constitution.	Status.	Ustion.	Pulsation.	Respiration.
3..........	Boy.	Puny.	Sleeping.	36° C.	70	36
1..........	"	"	"	36.25°	104	64
3..........	Girl.	"	"	36.25°	80	24
4..........	"	"	"	36.25°	88	28
3..........	"	"	"	36.50°	140	40
6..........	"	"	"	36.75°	120	44
1..........	"	"	"	36.75°	120	48
2..........	Boy.	"	"	36.75°	84	86
1..........	"	"	"	37°	80	36
1..........	"	"	"	37°	100	44
2..........	"	"	"	37°	120	46
2..........	Girl.	"	"	37°	84	44
3..........	Boy.	"	"	37°	112	32
4..........	Girl.	"	"	37°	104	34
4..........	"	"	"	37°	120	40
5..........	"	"	"	37°	84	32
5..........	"	Strong.	"	37°	96	36
5..........	Boy.	Pretty strong.	"	37°	112	42
7..........	"	Strong.	"	37°	128	50
3..........	Girl.	"	"	37°	84	42
4..........	"	"	"	37°	120	36
6..........	"	"	"	37°	120	38
2..........	"	"	"	37.25°	92	32
2..........	Boy.	Very strong.	"	37.25°	76	40
4..........	Girl.	"	"	37.25°	112	32
7..........	"	"	"	37.25°	116	37
1..........	Boy.	"	"	37.25°	80	40
5..........	Girl.	"	"	37.50°	76	24
6..........	Boy.	Pretty strong.	"	37.50°	112	32
2..........	"	Strong.	"	38°	112	38
4..........	"	"	"	38°	108	32
5..........	Girl.	"	"	38°	84	36
7..........	"	Pretty strong.	"	39°	124	44

Thus on thirty-three apparently healthy children the maximum temperature has been 39° C., the minimum 36°, and the medium 37.08; showing how much larger, without danger, are the *écarts* of temperature in infants than in adults.

APPENDIX VII.

(*a.*)—ROGER'S TABLE OF COMPARISON OF USTION, CIRCULATION, AND RESPIRATION OF TWENTY-FIVE CHILDREN FROM FIVE MONTHS TO FOURTEEN YEARS.

Age.	Ustion.	Pulsation.	Respiration.	Age.	Ustion.	Pulsation.	Respiration.
4 Months....	37° C.	120	36	6 Years.....	37. C.	80	24
4 "	37.25°	112	32	8 "	37.75°	84	28
5 "	37.25°	100	30	10 "	37.75°	80	20
6 "	36.75°	120	44	11 "	37.25°	88	26
6 "	37°	120	38	12 "	37°	70	28
6 "	37°	80	24	12 "	37°	82	28
9 "	36.75°	120	36	12 "	37.25°	74	34
9 "	37.25°	116	32	12 "	37.25°	70	34
2 Years......	37.25°	80	32	13 "	37.50°	88	32
3 "	37°	116	36	13 "	37.50°	70	30
4 "	37.50°	80	24	13 "	37.25°	80	30
4 "	37.75°	96	34	14 "	37.25°	68	26
5 "	36.75°	64	22				

Thus on twenty-five children, from their first to their fourteenth year, the maximum temperature was 37.75°, the minimum 36.75°, the medium of the thirteen youngest under seven years was 37.11, of the twelve above six years old 37.31°, and of the whole 37.21° C. At this age, therefore, the excursus does not present any more a larger *ecart* from the norme (1° C.) than in adults, as announced by Paul Bert, and life becomes safer.

(*b.*)—FORSTER'S (in *New Syd. Soc. Year Book*, 1862) TEMPERATURE-VARIATIONS WITHIN THE FIRST TWO DAYS AFTER BIRTH.

Hours after Birth.	Average Temperature (Reaumur).	Minimum Temperature (Reaumur).
¼—2	28.97°	28.2°
2—6	29.12°	28.1°
6—10	29.49°	28.7°
10—15	29.53°	29.0°
15—20	29.31°	29.8°
20—25	30.04°	29.7°
25—30	29.9°	29.7°
30—36	30.07°	29.7°
36—42	30.04°	29.4°
42—48	29.86°	29.3°

The average time of the highest temperature was from thirty to thirty-six hours after birth, at which it was 30.07° R. = 37.6° C. = .6° Ph. = 99.67° F. ; the maximum 30.40° R. = 38° C. = 1° Ph. = 100.4° F. ; the minimum 29.7° R. = 37.12° = .12° Ph. = 98.80° F. This elevation is independent of the food taken or not. A subsequent elevation always occurs, followed by two tide-like falls.

(*c.*)—TEMPERATURE OF THE FIRST NINE DAYS, FROM THE SAME AUTHOR.

Days.	Maxima (R.).	Minima (R.).	Media (R.).
1—1½	30.4°	29.7°	30.01°
1½—2	30.5°	29.3°	29.93°
2—2½	30.4°	29.3°	29.87°
2½—3	30.3°	29.2°	29.74°
3—3½	30.3°	29.3°	29.76°
3½—4	30.2°	29.0°	29.68°
4—4½	30.4°	29.2°	29.68°
4½—5	30.3°	29.2°	29.72°
5—5½	30.4°	29.2°	29.82°
5½—6	30.5°	29.3°	29.81°
6—6½	30.6°	29.4°	29.83°
6½—7	30.3°	29.1°	29.75°
7—7½	30.4°	29.3°	29.82°
7½—8	30.4°	29.0°	29.72°
8—8½	30.0°	29.4°	29.70°
8½—9	29.9°	29.6°	29.75°

APPENDIX VIII.

(*a.*)—ROGER'S LOCAL TEMPERATURES OF FIFTEEN CHILDREN FROM EIGHT TO THIRTEEN YEARS OLD.

Axilla.	Abdomen.	Mouth.	In the Arm-fold.	In the Shut Hand.	Between the closed Feet.	In the Groin.	At the Scrotum.
37.75°	37.50°	36.75°	36.50°	33.50°	31.50°	..	....
....	....	35°	....	30.50°	....	..	....
....	....	....	37.25°	....	....	..	....
....	....	....	35°	....	....	..	....
37.50°	....	37.75°	35.50°	34.75°	29°	..	37°
....	....	....	36.50°	....	....	..	....
....	....	....	37°	....	....	..	....
37.25°	....	....	36.50°	34.50°	....	..	....
....	....	....	36.80°	....	....	..	....
....	....	....	36.25°	....	....	..	....
....	....	....	35°	....	35°	..	....
....	....	....	36.25°	....	....	..	....
37°	37°	37.25°	35°	31.50°	31.50°	36°	35.75°
....	....	33°	....	....	....	..	....
....	37.25°	35.75°	36.75°	....	31°	..	.....

(*b.*)—TEMPERATURE OF SIX OTHER CHILDREN OF THE SAME AGE:

Axillary Temperature.	Rectal Temperature.
38.2°	38.2°
31.8°	37.2°
37.6°	37.8°
37°	37.4°
38°	38.4°
37.4°	37.8°

(*c.*)—J. DAVY'S LOCAL TEMPERATURES.

	Foot.	Hand.	Under the Tongue	Urine.
Before marching.....	21.4°	27.2°	36.7°	37.8°
After marching......	36.2°	35.8°	37.7°	38.3°

(*d.*)—LOCAL TEMPERATURES TAKEN BY DR. ALVARENGA ON TWO HUNDRED AND EIGHTY PATIENTS WITH THE FEVER THERMOMETER, ONCE COVERED WITH COTTON, THE OTHER TIME UNCOVERED.

Parts.	Local Temperatures.			
	Maxima.	Minima.	Media.	General Average.
Head..............................	37.2°	35.1°	36.05°	35.92°
	36.4°	34.6°	35.74°	
Thorax..	37.9°	32.0°	35.60°	35.20°
	36.0°	32.0°	34.55°	
Epigastrium........................	37.6°	34.0°	36.01°	35.66°
	36.8°	33.5°	35.21°	
Hypogastrium.......................	37.5°	34.5°	36.43°	35.94°
	36.8°	34.0°	35.30°	
Fold of arm........................	37.6°	35.5°	36.33°	36.26°
	37.0°	34.0°	36.16°	
Thigh..............................	37.5°	35.0°	35.86°	35.81°
	36.6°	34.6°	35.75°	
Groin...........	37.7°	34.5°	35.98°	35.95°
	37.6°	34.5°	35.92°	
Foot (under).......................	35.4°	31.0°	33.52°	33.20°
	34.4°	31.0°	32.70°	

(*e.*)—ALVARENGA'S COMPARATIVE TABLE OF LOCAL AND CENTRAL TEMPERATURES, WITH PULSE AND RESPIRATION, IN LYMPHANGITIS FOLLOWING THE BITE OF A RAT ON THE FIRST ARTICULATION OF A FINGER.

Days of Disease.	Point of Application of Thermometer.	Observation 9 to 10 A.M.			Observation 3 to 4 P.M.		
		Temperature.	Pulse.	Respiration.	Temperature.	Pulse.	Respiration.
4th.......	Axilla........ Sick part..... Opposite side.	38.9° 37.5° 35.5°	68	24	38.5° 36.7° 35.2°	68	24
5th.......	Axilla........ Sick part..... Opposite side.	37.6° 36.4° 34.8°	60	20	37.4° 36.4° 35.6°	64	18
6th.......	Axilla........ Sick part..... Opposite side.	36.8° 35.2° 34.1°	44	16			
7th.......	Axilla........ Sick part..... Opposite side.	36.0° 33.5° 32.5°	60	16			
8th.......	Axilla........ Sick part..... Opposite side.	36.2° 33.5° 33.8°	68	16			

(*f.*)—ALVARENGA'S COMPARATIVE TABLE OF LOCAL AND CENTRAL TEMPERATURES, IN LIGHT ORCHITIS OF THE RIGHT SIDE, ÆT. TWENTY-FOUR.

Days of Disease	Points of Application of Thermometer.	Observation 9 to 10 A.M.			Observation 4 P.M.		
		Temperature.	Pulse.	Respiration.	Temperature.	Pulse.	Respiration.
4th.....	Axilla.......... Sick testicle.... Healthy testicle.	37.1° 36.7° 36.4°	60	16	37.1° 36.7° 36.4°	62	16
5th.....	Axilla.......... Sick testicle.... Healthy testicle.	37.0° 36.6° 36.4°	62	16	37.0° 36.6° 36.4°	62	16
6th.....	Axilla.......... Sick testicle.... Healthy testicle.	37.0° 36.4° 36.4°	60	16	37.0° 36.4° 36.2°	60	16

(*g.*)—TABLE OF TEMPERATURE TAKEN IN THE DEAD-HOUSE OF GUY'S HOSPITAL, PROBABLY AFTER THE BODIES HAD BEEN WASHED, BY PLACING THE BALL OF THE THERMOMETER ON THE ABDOMEN.

(*From Dr. Taylor's Principles and Practice of Medical Jurisprudence*, p. 6.)

	First period 2 to 3 hours after death.		Second period 4 to 6 hours after death.		Third period 6 to 8 hours after death.		Fourth period 12 hours after death.	
No. of observations...........	76		49		29		35	
	F.	C.	F.	C.	F.	C.	F.	C.
Maximum temperature of the body......................	92°	34.4°	86°	30°	80°	26.6°	79°	26.1°
Minimum temperature of the body......................	60°	15.5°	62°	16.6°	60°	15.5°	56°	13.3°
Average temperature of the body......................	77°	25°	74°	23.3°	70°	21.1°	67°	19.4°

APPENDIX IX.

(*a.*)—SQUIRE'S THERMOMETRY OF THE PRE-ERUPTIVE AND CONTAGIOUS STAGE OF MEASLES.

a.—A girl, æt. 5, exposed to infection, March 30, shows abnormal temperatures before any other signs.

Days before Illness.	April.	Pulse.	Respiration.	Temperature, Axilla, at noon.	Remarks.
4	3	110	26	98.6°	Slight cough and coryza.
3	4	120	32	99.4°	Eyes red, tonsils full.
2	5	120	30	100.7°	Doubtful mottling of parts of skin.
1	6	104	30	99.0°	Face mottled.
0	7	100	26	97.3°	Skin clear, slight cough.
1st of illness.	8	110	26	99.2°	Respiration weak, a wheeze on forced inspiration.
2	9	130	30	100.3°	Ill, but not in bed.
3	10	130	40	100.5°	Respiration clear, spots of measles visible.
4	11	....	....	102.0°	Rash, purulent secretion from the conjunctiva.
5	12	....	....	......	Rash fully out, eyes better.

b.—Measles infectious before the eruption; a child on a visit leaves Feb. 13th with symptoms of illness, but no signs of measles till the 15th. A girl, æt. 10, had slept with this child from the 9th to the 13th, and remained at home, unexposed, after her visitor had left. She seemed ill on the 20th; had chorea on the 23d, with epistaxis in the evening, temperature 101.4°; rash of measles on the 24th, croupy cough at night, T. 103.6°; full rash on the 25th, croupy cough and tracheal sifle, T. 104°; next day temperature only 98.7°.

c.—Pre-eruptive and contagious stage of mumps (parotitis). A boy, æt. 13, exposed to infection of mumps at school by the end of September.

Days before Illness.	At Home, Oct.	Pulse.	Respiration.	Temperature. Morn.	Temperature. Even'g.	Remarks.
	1 to 5	......	......	......	......	Headache, uneasiness, fatigue.
Days of illness..						
1	6	......	......	......	......	One side of throat tender, and neck stiff.
2	7	100	24	101.2°	103.0°	Left parotid and right sub-maxillary gland enlarged, bowels open, urine free, delirious at night.
3	8	110	27	102.4°	102.4°	Face swelled, eyes red, vomiting, better at night.
4	9	84	26	100.2°		Swelling of parotid less hard, no pain.
5	10	68	24	98.4°		No swelling of parotids, a little of left submaxillary gland.
15	20	..	..	.....		Quite well, had felt weak till now, no metastasis, no relapse.

(*b.*)—PERIOD OF INCUBATION OF INFECTIOUS DISEASE.

Diseases.	Stage of Latency and Innocuity.	Stage of Invasion and Infection.	Remarks.
Vaccine	Days 4—5	Days ..	Infectious when the vesicle is formed and by its lymph.
Variola................	.. 12—14	.. ..	Infectious when the papules appear
" inoculated......	.. 3—4	.. 4—5	
Varicella	.. 10—12	.. ..	
Scarlatina	.. 3—7	.. ..	Exceptionally a few hours only, or a week of innocuity. Much less contagious in the first days of the eruption than in those of desquamation.
"	.. ..	.. ..	
Roseola................	.. 10—14	.. ..	
Measles	.. 12—14	.. ..	Initial depression of temperature less than in scarlatina.
" inoculated.....	.. 7 "	.. ..	
Parotitis	.. 14—21	.. ..	
Whooping-cough	.. 4 "	.. 7	Catarrhal stage highly infectious.
Influenza	.. 4—8	.. ..	Infectious shorter when catarrhal, longer when herpetic.
Typhoid fever..........	.. 10—12	.. ..	Infectious from a single night exposure for a long time.
Typhus................	.. 12 ..	.. ..	Infectious rarely more or less than the 12th day.

Diseases.	Stage of Latency and Innocuity.	Stage of Invasion and Infection.	Remarks.
Remittent fever.......	Days 14—21	......	
Intermittent fever.....	" 12 "	......	Incubation sometimes shorter or longer.
Dengue	" 3—4		
Relapsing fever.......	" "	......	Infection illimited and uncertain infection.
Yellow fever..........	" 2—5	......	Infection rarely 8 to 10 days. Specific smell prodromic.
Plague	" 2—15		
Cholera	" 3—5		"A few days' incubation" is the answer of the cholera commission sitting (1865) in Constantinople.
Snake-bite............		At once.	With chilliness.
Glanders—Farcy......	" 3—30	" "	According if inoculated or contagious.
Rabies	" 40—120	" "	Examples of latency of above a year.
Diphtheria and........	" "	" "	Infection likely extends farther than has been observed.
Epidemic pneumonia..	" 3—8		

There is a great deal more to learn about the periods of latency (innocuity and incubation), and the period of infection (proliferation and propagation).

(c.)—MEAN TEMPERATURE IN SOME DISEASES OF CHILDREN.

Disease.	Authorities.	Minima.	Maxima.	Media.	Remarks.
Bronchitis, simple...	....	....	100° F.	....	
" complicated	....	103° F.	....	....	And above as high as the temperature of the complication.
Pneumonia	....	....	105.8°	....	
Pleurisy............	....	99°	104°	101.5°F.	
Peritonitis..........	....	98.7°	105°	103°	
Dysentery	....	99.2°	101.2°	100.7°	
Enteritis	....	98.7°	102°	99.5°	
Pericarditis.........	....	105.5°	103.5°	101.5°	In two cases with rheumatism, and one after scarlet fever.
Thrush	....	95°	102°	100°	
Meningeal tubercles.	....	198°	102°	100°	
Meningitis..........	....	100°	108.5°	102°	
Scarlatina	Squire.	....	104.5°	....	Convulsions with or before the eruption.
"	Roger.	....	102.9°	....	
"	Moreau.	....	103.3°	....	
Measles	Roger.	....	99.95°	....	
"	Moreau.	....	102.2°	....	
Mumps.............	....	....	103°	....	
Tooth-rash — Zoster.	....	101°	103°	102°	
Varicella	....	98.7°	102.2°		
Small-pox	....	98.7°	106°		
"	Squire.		102.2°	102.2°	
"	Roger.		101.75°	101.75°	
"	Moreau.			102.2°	

(*d.*)—ROGER'S AVERAGE TEMPERATURE OF CHILDREN IN ACUTE AFFECTIONS OF THE DIGESTIVE ORGANS.

Peritonitis	39.55° C.	= 103.19° F.
Dysentery	38.16° "	= 100.70° "
Stomatitis	38.08° "	= 100.50° "
Enteritis	37.96° "	= 100.30° "
Thrush	37.85° "	= 100.13° "

APPENDIX X.

MATHEMATICAL CHART OF USTION, CIRCULATION, AND RESPIRATION.

(FILLED BY A MOTHER.)

NAME, GRACE G...... AGE, 10. SEX, FEM. DISEASE, SCARLATINA.

Norme of Temperature, .2. Of Pulse, 84. Of Respiration, 26.

1872. MONTH, DECEMBER.	16		17		18		19		20		21		22		SEPTENARY No. 1.		
DAYS OF DISEASE.	I.		II.		III.		IV.		V.		VI.		VII.		Maximum day, the 5th....	3.8	
															Minimum day, the 7th.....	1.5	
HOURS OF OBSERVATION.	M	E	M	E	M	E	M	E	M	E	M	E	M	E	Total of morn. temp......	15.75 :	7 = 2.2
															Total of even. temp.......	18.7 :	7 = 2.7
General temperature taken at the axilla. Fever............	1.6	2.2	1.7	2.1	2.4	2.4	2.8	2.9	3.25	3.8	2.5	2.8	1.5	2.5	Total up.................	34.45	
Zero Health....... 0															Zeros....................	"	
Depression........															Total down..............	"	
Daily average..........	1.9		1.9		2.4		2.85		3.52		2.65		2		Average of temp...........	17.22 :	7 = 2.46
Daily difference........	.6		.4		0		.1		.55		.3		1		Id. of difference............	2.95 :	7 = .42
Pulse........................	130	140	127	135	135	120	72	100	132	136	120	116	104	104	Id. of pulse................	1672	: 14 = 120
Respiration..................	30	36	32	40	38	40	36	40	36	36	32	34	32	35	Id. of breathing............	497	: 14 = 36.5

MATHEMATICAL CHART OF USTION, CIRCULATION, AND RESPIRATION.—(*Continued.*)

Name, Grace G...... Age, 10. Sex, Fem. Disease, Scarlatina.								Septenary No. 2.	
Norme of Temperature, .2. Of Pulse, 84. Of Respiration, 26.									
1872. Month, December.	23	24	25	26	27	28	29		
Days of Disease.	VIII.	IX.	X.	XI.	XII.	XIII.	XIV.	Maximum day, the 12th...	2.6
								Minimum day, the 13th....	.1
Hours of Observation.	M E	M E	M E	M E	M E	M E	M E	Total of morn. temp......	6.35 : 7 = .9
								Total of even. temp.......	9.35 : 7 = 1.3
General temperature taken at the axilla. Fever.............	1.9 2.2	1.25 1.5	.9 .5	.5 1.4	.1 2.6	.1 "	.7 "	Total up..................	15.35
Zero Health....... 0	—	—	—	—	—	—	—	Zeros....................	"
Depression........								Total down...............	"
Daily average..........	1.55	1.37	.7	.95	1.8	.1	.7	Average of temp...........	7.17 : 7 = 1.2
Daily difference........	.3	.25	.4	.9	1.6	"	"	Id. of difference...........	3.45 : 5 = .7
Pulse........................	86 106	102 104	100 "	96 "	102 "	100 "	100 "	Id. of pulse................	992 : 9 = 110
Respiration..................	30 36	34 32	28 "	28 "	31 "	27 "	28 "	Id. of breathing............	247 : 9 = 30

*** The other signs and symptoms, as well as the treatment—which happily was of the simplest nursery kind—have been omitted, to not obstruct the mathematical course of the case.

APPENDIX XI.

MATHEMATICAL RECORD OF TWO CASES OF ERYSIPELAS.

No. 1. Name, S...... Age, 45. Sex, F. Disease, Erysipelas.								One Septenary.	
1872. February.	23	24	25	26	27	28	29	Maximum days, the 3d and 4th..................	5
Days of Disease.	I.	II.	III.	IV.	V.	VI.	VII.	Minimum day, the 7th.....	2
	M — E	M — E	M — E	M — E	M — E	M — E	M — E		
General temperature taken at the axilla. Fever............	3.2 4	4 4.2	4 5	5 4	3.2 3.1	3 4	3 2	Total up................	51.7 : 14 = 3.7
Zero Health....... 0	—	—	—	—	—	—	—	"	" "
Depression								Total down..............	" "
Daily average..........	3.6	4.1	4.5	4.5	3.15	3.5	2.5	Total of temp.............	25.85 : 7 = 3.7
Daily difference........	.8	.2	1	1	.1	1	1	Id. of difference............	5.1 : 7 = .72
Local temp. (1).... above / below 0	6	6.5	7	6.3	4.2	2	2	Id. of local temp...........	4.9
Pulse........................	100 106	104 112	108 118	96 89	80 82	80 100	77 72	Id. of pulse................	94.5
Respiration....................	28	22	20	22	17	16	16	Id. breathings in effervesc.. / defervesc.	23 / 16⅓

MATHEMATICAL RECORD OF TWO CASES OF ERYSIPELAS.—(*Continued.*)

No. 2. Name, E...... Age, 24. Sex, F. Disease, Erysipelas.								Septenary No. 1.	
1872. March.	23	24	25	26	27	28	29		
Days of Disease.	I.	II.	III.	IV.	V.	VI.	VII.	Maximum day, the 1st..... / Minimum day, the 6th.....	7 / .7 and 0
	M E	M E	M E	M E	M E	M E	M E		
General temperature taken at the axilla. Fever............	7 4	2.5 5.5	3 6	3 5.7	2.5 5.6	.7	1.4 2.3	Total up.................	49.2 : 14 = 3.5
Zero Health....... 0						0		One zero.................	
Depression........								Total down...............	" "
	5.5	3	4.5	4.35	4.05	.35	1.85		
Daily average.........								Average of temp..........	23.6 : 7 = 3.34
	3	3	3	2.7	3.1	.7	.9		
Daily difference.......								Id. of difference............	16.4 : 7 = 2.35
Local temp....... above	2	8	8.5	4	4.8	2	2		
0								Id. of local temp...........	31.3 : 7 = 4.5
below									
Pulse........................	122 125	112 115	98 120	104 115	102 122	108 80	80 88	Id. of pulse................	1501 : 14 = 107

MATHEMATICAL RECORD OF TWO CASES OF ERYSIPELAS.—(*Continued.*)

No. 2. Name, E...... Age, 24. Sex, F. Disease, Erysipelas.								Septenary No. 2.	
1872. March—April.	30	31	1	2	3	4	5	Maximum day, the 10th...	6.2
Days of Disease.	VIII.	IX.	X.	XI.	XII.	XIII.	XIV.	Minimum days, the 12th and 14th...............	.7
	M E	M E	M E	M E	M E	M E	M E		
General temperature taken at the axilla. Fever............	3.2 6.6	5.8 6	2.3 6.2	2.2	.2	.3 1.2		Total up..................	34 : 14 = 2.42
Zero Health....... 0				0	.7		0 .7	Two zero.................	
Depression........								Total down..............	1.4 : 14 = .1
	4.9	5.9	4.25	1.1		.75			
Daily average..........								Average of temp...........	15.4 : 7 = 2.2
					.25		.35		
	3.4	.2	3.9	2.2	.9	.9	.7		
Daily difference.......								Id. of difference............	12.2 : 7 = 1.7
Local temp.. ... above	3.5	5	4.5	1					
0					0	0	0	Id. of local temp...........	14 : 7 = 2
below									
Pulse........................	98 120	106 116	104 96	92 64	70 82	82 84	82 88	Id. of pulse................	1264 : 14 = 90

MATHEMATICAL RECORD OF TWO CASES OF ERYSIPELAS.—(*Continued.*)

No. 2. Name, E...... Age, 24. Sex, F. Disease, Erysipelas.															Septenary No. 3.	
1872. April.	6		7		8		9		10		11		12		Maximum days, the 16th and 17th..............	5
Days of Disease.	XV.		XVI.		XVII.		XVIII.		XIX.		XX.		XXI.		Minimum days, the 15th and 19th............	.9, .8, .6
	M	E	M	E	M	E	M	E	M	E	M	E	M	E		
General temperature taken at the axilla. Fever............			3.8	5	5	1.7				.5		.5			Total up................	16.5 : 14 = 1.2
Zero Health....... 0	0						0								Two zero................	
Depression........		.9						.8	1		.5		.6	.4	Total down..............	3.3 : 14 = .23
			4.4		3.35											
Daily average........											0				Average of temp..........	5.65 : 7 = .8
	.45						.4		.75				.5			
	.9		1.2		3.3		.8		1.5		1		.2			
Daily difference.......															Id. of difference...........	8.9 : 7 = 1.2
Local temp....... above	2		3.5		4.3											
Local temp....... 0											0				Id. of local temp..........	7.3 : 7 = 1
Local temp....... below							2		1				.5			
Pulse.......................	78	88	98	96	76	92	76	76	65	82	66	82	68	82	Id. of pulse...............	1025 : 14 = 73

APPENDIX XII.

PUERPERAL TEMPERATURES.

(*a.*)—DURING THE *montée* OF MILK.

G......, æt. 27.		Decimal Measures.					
		Pulse.	Temper.	Urine.	Gravity.	Urea.	Chlore.
April 21..	7 A.M., successful delivery..	82	37.5°	....	....	....	....
" 22..	Bosom flabby...............	68	37.6°	800 gr.	10.20	18.	4.53
" 23..	Breast full; child begins to suck; no chill; hot skin; cephalalgy	64	37.6°	1230 "	10.23	34.44	10.13
" 24..	All well..................	58	37.5°	830 "	10.22	25.32	5.13
" 25..	Breasts not so tense; eats well.............	56	37.4°	900 "	10.20	22.	5.60
" 26..	And following days, plenty of milk					20–23	5–600

(*b.*)—QUINQUAND'S TEMPERATURE, ETC., IN TRAUMATIC PUERPERAL FEVER.

H...., æt. —.		Decimal Measures.					
		Pulse.	Temper.	Quantity Urine.	Sp. Gravity.	Urea.	Chlore.
April 18..	No hemorrhage; child living.	84	37.7°	....	....	.....	......
" 19..	Uterine colics; no tenderness on pressure; vulva lacerated; small lips tumefied.	92	38.9°	1600 gr.	1018 carmine-red.	21	8
" 20..	Great pain in the right hypochondrium; 6 dry cuppings; reliefs; vulva swollen; no induration.	108	39.9°	2120 "	1010 light-red.	29.50	10
" 21..	No pain; good sleep; milk well up.	104	39.3°	900 "	1013 light-yellow.	19.55	4.98
" 22..	Vulva yet tumefied; uterus contracting normally; pression insensible.	96	38.5°	700 "	1018 orange-yellow.	17.22	2
" 23..	Eats well; sleeps well.	84	38.4°	900 "	1020 orange-yellow.	19	1.89
" 24..	Same condition.	80	38.3°	1200 "	1021	22	1.50
" 25..		76	38.2°	1650 "	1017 orange.	38	5.62

(*c.*)—LIGHT INFANTILE PUERPERISM OF INFANT (*cure*).

	R.... Mother, æt. 27, being well.		Temperature.	Weight.
Feb. 26..	11 P.M., natural delivery..................		....	....
" 27..	....	morning.	36.8°	....
		evening .	37°	2900
" 28..	No diarrhœa........................	morning.	37.8°	2900
		evening..	37.6°	2800
March 1..	Do not suckle; complains; pale; vomits;	morning.	37.9°	2740
	distended abdomen..................	evening..	38.2°	2700
" 2..	Suckle a little; green diarrhœa; bilious; vomiting; somnolence; swollen abdomen........................	morning. / evening..	38.8° / 38.9°	2675
" 3..	Diarrhœa continues..................	morning. / evening..	35.5° / 35.9°	2750
" 4..	Tries to suckle; pale in the evening....	morning. / evening..	37.8° / 37.9°	2710
" 5..	Improved facies; suckles better........	morning. / evening..	37.5° / 37.7°	2710
" 6..	Suckles well; pale yet..............discharged at		37.8°	2715

(*d.*) IN INFANTILE PUERPERISM OF INFANT (*death*).

	P...., Male. Mother, æt. 23. Has had pelvi-peritonitis. Cured.		Temperature.	Weight.
April 13..	Passes meconium; does not seem to suffer	morning. / evening .	37.6° / 37.6°	3770
" 14..	Little sucking........................	morning. / evening..	37.4° / 37.5°	3670
" 15..	Cries all night; some diarrhœa; swollen abdomen; loss of flesh sensible...	morning. / evening..	38.8° / 38.8°	3570
" 16..	Vomited; abdomen tense, traversed with blue veins; some diarrhœa......	morning. / evening..	39. / 38.2°	3470
" 17..	Abdomen tense; sensible; vomit green; refuses food; mouth dry; features altered; scrotum tumefied, etc........	morning. / evening..	39.1° / 38.5°	3370
" 18..	Bilious vomit; green stools; emaciation; hippocratic facies..............	morning. / evening..	39.5° / 40.0°	3270
	Death in the night.			

(*e.*)—INFANTILE PUERPERISM COMPLICATED WITH MENINGITIS (*death*).

1st day.....	After birth; is well; nurses.............	Loss of weight,	80 gram.
2d "	Temperature 36.7° C......................	" " "	120 "
3d "	" "	Increase of weight,	50 "
4th "	" "	Loss " "	180 "
5th "	" "	" " "	20 "
6th "	Sucks well to this day...................	Stationary,	...
7th "	Intermittent and convergent strabism....	Loss of weight,	10 "
8th "	Temperature rises; thrush.............	Stationary,	...
9th "	No more suckling; local and general convulsions alternately....................	Loss of weight,	90 "
10th "	Temperature 41.1° C., morning and evening; intense convulsions; death.......	" " "	85 "
	Autopsy: purulent meningitis.		

APPENDIX XIII.

(a.)—WILSON FOX'S TABLES OF TEMPERATURE, SHOWING THE EFFECTS OF THE TREATMENT BY COLD.

MRS. BROPHY

Date.	Hour.	Temp.	Pulse.	Resp.		Remarks.
June 5. 9th day of disease.	8.0 p.m.	102.9	88	30		
June 6.	11.0 a.m.	101.2				
	10.0 p.m.	100.	88	28		
" 7.	10.0 a.m.	99.66	80	32		
	11.0 p.m.	100.9	92	28		
" 8.	12.0 noon	100.6				
	9.0 p.m.	100.7	88	42		
" 9.	11.0 a.m.	99.2	84	36		
	9.0 p.m.	101.2	88	30		
" 10. 14th day of disease.	9.0 a.m.	*				* Not ex. 102°.
	3.0 p.m.	105.0	...	...	Ax.	
	4.0 p.m.	106.3	..	...	Ax.	
	4.30 p.m.	105.7	...	...	Ax.	
	5.30 p.m.	105.6	...	...	Ax.	
	6.0 p.m.	106.4	122	44	Ax.	Quin. ℈j.
	6.25 p.m.	106.2	112	44	Ax.	
	6.45 p.m.	106.6	104	42	Ax.	Quin. ℈j.
	7.5 p.m.	106.2	108	40	Ax.	
	7.20 p.m.	106.2	112	40	Ax.	Quin. ℈j.
	7.35 p.m.	106.4	112	38	Ax.	
	7.50 p.m.	106.9	120	40	Ax.	Quin. ℈j.
	8.5 p.m.	107.1	118	42	Ax.	
	8.20 p.m.	107.3	116	40	Ax.	Quin. ℈j.
	8.40 p.m.	107.6	112	36	Ax.	
	8.55 p.m.	107.8	120	34	Ax.	Quin. ℈j. Vomited.
	9.15 p.m.	108.4	122	32	Ax.	Unconscious.
	9.30 p.m.	109.2	136	36	Ax.	Bath 96°.
	9.50 p.m.	109.1	...	...	Rec.	
	9.55 p.m.	110.0	...	...	Rec.	Iced water poured over patient.
	10.10 p.m.	109.4	...	...	Rec.	
	10.15 p.m.	108.4	...	...	Rec.	
	10.20 p.m.	107.5	120	...	Rec.	Spinal icebag.
	10.25 p.m.	106 2	140	...	Rec.	Partly conscious.
	10.30 p.m.	104.0	...	...	Rec.	
	10.35 p.m.	.103.6	...	...	Rec.	Taken from bath at temp. 63°.
	10.50 p.m.	101.5	...	...	Rec.	
	10.55 p.m.	100.6	...	...	Rec.	Patient can speak.
	11.5 p.m.	99.5	...	...	Rec.	Rigidity of lips and of muscles of neck.
	11.10 p.m.	99.5	...	...	Vag.	
	11.25 p.m.	97·4	130	...	Vag.	
	11.40 p.m.	97.4	...	...	Vag.	Pulse imperceptible; warmth to feet and spine.
	11.55 p.m.	98.0	...	...	Vag.	
June 11. 15th day.	12.2 a.m.	98.2	...	...	Vag.	
	12.20 a.m.	98.3	130	42	Vag.	
	12.35 a.m.	98.3	...	...	Vag.	

Date.	Hour.	Temp.	Pulse.	Resp.		Remarks.
BROPHY—*cont.*	12.45 a.m.	....	120			
June 11—*cont.*	12.55 a.m.	98.9	...	...	Vag.	
	1.15 a.m.	99.4	188	32	Vag.	Asleep.
	1.40 a.m.	99.2	...	...	Ax.	
	2.15 a.m.	101.1	...	...	Ax.	
	2.55 a.m.	101.4	116	40	Vag.	
	4.0 a.m.	102.4	108	36	Ax.	
	5.0 a.m.	102.9	...	...	Ax.	
	6.30 a.m.	103.4	...	...	Ax.	
	7.15 a.m.	103.8	...	...	Ax.	
	7.35 a.m.	104.5	...	...	Rec.	
	7.40 a.m.					Bath, 64°.
	7.45 a.m.	105.0	...	...	Vag.	
	7.50 a.m.	104.6	...	...	Vag.	
	8.0 a.m.	103.9	...	...	Vag.	Taken from bath, 66°.
	8.7 a.m.	102.0	...	...	Vag.	
	8.15 a.m.	101.7	...	...	Vag.	
	8.30 a.m.	100.8	...	...	Vag.	Rigor; warm bottles.
	8.40 a.m.	99.4	108	...	Mouth	Rigor.
	8.50 a.m.	99.9 / 99.8	84	25	Rec. / Mou.	
	9.10 a.m.	99.4	...	...	Mouth	
	9.40 a.m.	99.9	...	...	Mouth	
	10.0 a.m.	100.0	...	...	Mouth	
	10.45 a.m.	100.4	...	...	Mouth	Hot bottles removed.
	12.15 p.m.	100.7	...	...	Mouth	
	1.45 p.m.	100.9	...	...	Ax.	
	3.0 p.m.	100.7	96	30	Ax.	Perspiring freely.
June 12.	12.15 a.m.	101.2	...	...	Ax.	
16th day.	1.0 a.m.	100.8	...	...	Ax.	
26 hours.	4.0 a.m.	101.0	...	...	Ax.	
	7.30 a.m.	100.2	...	...	Ax.	
	9.40 a.m.	99.8	...	...	Ax.	Cardiac dulness at 3d
	10.30 a.m.	100.7	...	...	Ax.	cartilage.
	3.10 p.m.	101.3	120	...	Ax.	Pains in knees.
	8.50 p.m.	102.1	...	...	Ax.	
	9.20 p.m.	102.2	...	...	Ax.	
	9.45 p.m.					Ice-bag to spine, 3
	9.55 p.m.	101.6	...	...	Mouth	hours.
	11.45 p.m.	101.8	...	...	Ax.	
June 13.	12.40 a.m.	101.0	...	...	Mouth	Ice-bag removed.
17th day.	12.55 a.m.	100.5	100	30	Mouth	
50 hours.	1.25 a.m.	101.6	...	...	Ax.	
3d day.	4.40 a.m.	101.6	...	...	Ax.	
	5.10 a.m.	102.4	...	...	Ax.	Ice-bag applied 3 hours.
	5.40 a.m.	101.5	...	...	Ax.	
	8.15 a.m.	100.9	...	...	Ax.	Ice-bag removed.
	8.50 a.m.	101.2	104	26	Ax.	
	9.50 a.m.	101.9	...	...	Ax.	Râles in both lungs.
	12.0 noon	102.5	...	...	Ax.	Ice-bag, 18 hours.
	12.48 p.m.	102.6	...	...	Ax.	
	2.53 p.m.	101.4	...	...	Ax.	
	3.55 p.m.	101.7	...	...	Ax.	
	4.45 p.m.	101.8	...	...	Ax.	
	6.15 p.m.	102.2	...	...	Ax.	
	10.0 p.m.	101.9	96	32	Ax.	
June 14.	2.0 a.m.	101.4	...	...	Mouth	
18th day.	3.0 a.m.	101.0	...	...	Ax.	
76 hours.	6.0 a.m.	101.6	...	...	Ax.	Ice-bag removed.
4th day.	8.0 a.m.	101.8	...	...	Ax.	
	8.30 a.m.					Ice-bag, 1½ hour.
	9.20 a.m.	101.8	...	...	Mouth	Ice-bag removed.
	10.0 a.m.	102.1	...	...	Ax.	
	10.25 a.m.	102.1	...	...	Ax.	

Date.	Hour.	Temp.	Pulse.	Resp.		Remarks.
BROPHY—*cont.*	11.25 a.m.	101.5	...	...	Ax.	
June 14—*cont.*	2.50 p.m.	101.3	...	...	Ax.	
	3.40 p.m.	102.1	...	...	Ax.	
	4.30 p.m.	101.7	...	...	Ax.	
	6.0 p.m.	102.2	...	...	Ax.	8 P.M. Râles in lungs.
	11.0 p.m.	102.8	...	...	Ax.	Some dulness, right base
June 15.	2.30 a.m.	103.2	...	...	Ax.	Ice-bag applied 6¼
19th day.	3.0 a.m.	102.6	...	...	Ax.	hours.
104 hours.	4.0 a.m.	102.0	...	...	Ax.	"
5th day.	5.0 a.m.	101.8	...	...	Ax.	"
	7.0 a.m.	102.4	...	...	Ax.	"
	8.45 a.m.	101.4	...	...	Ax.	Ice-bag removed; not
	9.40 a.m.	101.7	96	...	Ax.	again applied.
	10.30 a.m.	100.5	...	...	Ax.	
	12.15 p.m.	101.8	...	...	Ax.	9 A.M. Dulness, right
	1.15 p.m.	102.3	...	...	Ax.	base, disappeared;
	3.15 p.m.	102.7				still râles in lungs.
	7.15 p.m.	101.9				
	8.30 p.m.	102.7				
	11.30 p.m.	101.8				
June 16.	12.30 a.m.	102.4				
20th day.	4.0 p.m.	100.0				
6th day.	11.30 p.m.	99.8				
June 17. 21st day.	2.0 a.m.	99.8				17th. Sibilant râles in
7th day.	10.35 p.m.	98.4				lungs.
June 18. 22d day.	8.45 a.m.	99.1				
8th day.	9.0 p.m.	99.2	88	24		
June 19. 23d day.	11.0 a.m.	98.2				22. Râles disappeared
9th day.	10.0 p.m.	98.4				from lungs.
July 1. 35th day.	M.	100.0				
18th day.	E.	98.5				

(*b.*)—WILSON FOX'S TABLE SHOWING THE EFFECT OF THE BATHS IN THE REDUCTION OF TEMPERATURE.

BROPHY.

FIRST BATH.

Time in Bath.	Rise or Fall.	Temp.	Temp.	Amount of reduction.	Time.	Average reduction per minute.	Remarks.
15m.*	fall	0.6	110°				* Iced water.
5m.	"	1.0					
5m.	"	0.9					
5m.	"	1.3					
5m.	"	2.2					
5m.	"	0.4	103.6	6.4	40m.	0.16	
After Bath.	"						
15m.	"	2.1					
10m.	"	2.0					
20m.	"	2.1	97.4	6.2	45m.	0.13	

SECOND BATH.

Time after Immersion.	Rise or Fall.	Temp.	Temp.	Amount of reduction.	Time.	Average reduction per minute degrees.	Remarks.
10m.	rise	0.5	104·5 to 105				
5m.	fall	0.4					Bath 64°, rose to 66°.
10m.	"	0.7	103·9	1.1	15m.	0.07	
After Bath.	"						
7m.	"	1.9					
8m.	"	0.3					
15m.	"	0.9					
10m.	"	1.4*	99·4	4.5	40m.	0.11	* Mouth.

(c.)—W. H. DRAPER'S TABLE SHOWING (1) THE EFFECT OF THE BATH ON THE TEMPERATURE, (2) THE PROMPT REACTION FOLLOWING SHORT BATH, (3) THE EFFECT OF THE BATH IN RELIEVING THE HEAD-SYMPTOMS.

Admitted 20th March, 1875. No. 2.—D. FOREST, adult male.

Day.	Hour.	Temperature.	Clinical Remarks.
1	......	103° F.	The cold pack was used on the fifth day of disease without effect on the temperature. Two hours later the first bath was given, reducing the temp. from 107.3° to 99.3°. Each subsequent bath, as will be seen from the table, reduced the temp. in the same marked manner. The delirium and subsultus which accompanied the high temp. subsided in every instance after the bath. The temp. of the baths was from 70° to 80° Fahr. when the patient was immersed, and was lowered after immersion to 55° or 60°. The duration of the baths was from 5 to 11 minutes.
3	......	104°	
5	9.00 A.M.	104.5°	
5	3.45 P.M.	106.2°	
5	5.30 "	107.3°	
5	6.00 "	99.3°	
5	8.00 "	105.5°	
5	8.30 "	99°	
5	9.00 "	102.5°	
5	10.30 "	105.7°	
5	12.45 "	99.5°	
6	2.00 A.M.	106.2°	
6	2.10 "	100°	
6	4.15 "	105°	
6	4.45 "	100°	
6	11.30 "	105°	
6	11.45 "	97.7°	
6	3.10 P.M.	104.7°	
6	3.30 "	100.7°	
6	8.00 "	105°	
6	8.15 "	101.5°	
6	12.00 "	105°	
6	12.10 "	101.2°	
7	2.30 P.M.	103.2°	

These cases of W. Fox and W. H. Draper would read more easily, and present their conclusions much more forcibly, if they were divided into septenaries, and written in the figures of the physiological scale of thermometry employed in Appendices X. and XI. The latest records of the treatment of hyperpyrexia by cold are from W. H. Thomson of the Bellevue Hospital, of this city, in the New York Medical Record (Nov.), and from Sydney Ringer of the University Hospital, London, in the British Medical Journal (Oct.).

Day.	Hour.	Temperature.	Clinical Remarks.
8	6.00 P.M.	102.5°	Brandy; perfectly rational.
9	6.00 "	102.5°	Swelling and tenderness of joints reappear.
10	6.00 "	101.5°	No other symptoms nor grave complications.
31	6.00 "	100°	Nothing new nor grave.
May 5.	......	......	Discharged.

W. H. DRAPER, Visiting Physician to the Roosevelt Hospital.
MEYNARD, House Surgeon.

APPENDIX NO. XIV.

TEMPERATURE IN YELLOW FEVER.

(a.)—JOSEPH JONES' (OF NEW ORLEANS) THERMOMETRIC AND SPHYGMOMETRIC TABULATION OF FORTY-EIGHT CASES.

No. of Cases.	Temperature and Pulse.	Days of Disease.										Result and Remarks.
		1	2	3	4	5	6	7	8	9	10	
1	Pul.	108	118	118	.....	.....	.....	.....	.....	.....	.....	Death on 3d day.
	Tem.	103.5	106.8	108	.....	.....	.....	.....	.....	.....	.....	
2	Pul.	110	110	108	100	.....	120	.....	.....	.....	.....	Death on 9th day.
	Tem.	108	108	108	108	110	110	110	.....	100	.....	
3	Pul.	120	120	.....	.....	.....	.....	.....	.....	.....	.....	Death on 17th day.
	Tem.	108	108	108	108	109	110	110	.....	110	110	
4	Pul.	.....	110	90	.....	96	.....	.....	.....	.....	.....	Death on 11th day.
	Tem.	.....	106	107	108	.....	108	110	.....	110	98	
5	Pul.	110	110	.....	.....	.....	.....	.....	.....	.....	.....	Death on 7th day.
	Tem.	107	108	.....	.....	.....	.....	.....	.....	.....	.....	
6	Pul.	100	.....	120	.....	.....	.....	.....	.....	.....	.....	Death on 3d day
	Tem.	107	108	109	.....	.....	.....	.....	.....	.....	.....	
7	Pul.	.....	110	100	140	.....	.....	.....	.....	.....	.....	Death on 6th day.
	Tem.	.....	109	109.5	....	110	.....	.....	.....	.....	.....	
8	Pul.	100	.....	96	.....	90	100	100	.....	.....	.....	Recovered.
	Tem.	.....	105	105.5	.....	.....	100	.....	.....	.....	.....	
9	Pul.	110	100	.....	120	120	126	.....	.....	.....	.....	Death on 6th day.
	Tem	109	.....	.....	.....	100	.....	.....	.....	.....	.....	
10	Pul.	90	85	90	85	.....	.....	.....	.....	....	.....	Death on 4th day.
	Tem.	108.5	.....	.....	.....	.....	.....	.....	.....	.....	.....	
11	Pul.	100	90	86	86	80	86	.....	.....	.....	.....	Death on 8th day.
	Tem.	107	.....	.....	107	.....	.....	.....	.....	.....	.....	
12	Pul.	.....	110	100	90	110	90	.....	.....	.....	.....	Recovered.
	Tem.	105	105	105	104	104	100	.....	.....	.....	.....	
13	Pul.	.....	.....	100	.....	.....	.....	.....	.....	.....	.....	Recovered.
	Tem.	.....	105	100	.....	.....	.....	.....	.....	.....	.....	
14	Pul.	118	90	80	76	70	68	60	.....	.....	.....	Convalescent on 5th day.
	Tem.	103.5	101.9	101	99.4	99.4	98.8	98.8	.....	.....	.....	
15	Pul.	118	110	78	70	70	68	60	.....	.....	.....	Convalescent on 4th day.
	Tem.	103	101.4	100	99	99	99	99	.....	.....	.....	
16	Pul.	116	82	84	82	78	76	80	74	60	64	Case protracted on account of formation of parotid abscess; recovered.
	Tem.	103 2	101.8	101.8	101.6	101.6	101.6	102.2	100.8	101.2	99.2	
17	Pul.	86	62	70	60	60	.....	.....	.....	....	.....	Convalescent on 5th day. Veratrum viride; rapidly reduced pulse.
	Tem.	104	101.2	101.2	100.2	99.2	.....	.....	.....	.....	.....	
18	Pul.	102	94	88	80	.....	.....	.....	.....	.....	.....	Convalescent on 4th day.
	Tem.	104.4	100.6	99.4	99	.....	.....	.....	.....	.....	.....	

No. of Cases.	Temperature and Pulse.	Days of Disease.										Result and Remarks.
		1	2	3	4	5	6	7	8	9	10	
19	Pul.	126	100	90	94	84	80	.....	.....	.....	.....	Death on 6th day. Male, æt. 67.
	Tem.	104.6	104	102.2	102 2	100	99	.....	.....	.....	.....	
20	Pul.	110	75	60	.....	...	.....	.....	.....	.....	.....	Male child; convalescent on 3d day.
	Tem.	104.5	101.4	100.4	.....	.....	.....	.....	.....	.....	.....	
21	Pul.	120	106	90	82	92	110	90	80	70	100	Adult male; on 3d day abscess of elbow commenced: convalescent on 7th day.
	Tem.	104.4	103.5	103.6	104.9	104.8	102.8	101.5	101.2	101	100 8	
22	Pul.	120	80	62	80	70	70	70	70	.....	.....	Veratrum viride in 20-drop doses rapidly reduced pulse. Convalescence on 7th day.
	Tem.	105	101.2	100.4	101.8	99.5	99	99.5	99	.....	.....	
23	Pul.	120	112	110	76	76	.....	.....	.....	.....	.....	Adult male, æt. 63; died 5th day.
	Tem.	105.8	105	104	100.4	98.5	.....	.....	.....	.....	.....	
24	Pul.	.....	100	86	80	70	70	.....	.....	.....	.....	Male child; on 4th day indigestion raises the temperature; convalescent on 6th day.
	Tem.	.....	101.8	100	100	99	98.8	.....	.....	.....	.....	
25	Pul.	122	110	102	100	130	.....	.....	.....	.....	.....	Death on 15th day.
	Tem.	102 2	103.2	101.9	100.1	100.9	.....	.....	.....	.....	.....	
26	Pul.	150	120	100	90	88	100	70	84	.....	.....	Urticaria the 5th day causes oscillations of temperature; convalescent on 7th day.
	Tem.	103.4	104	102.5	102 2	101	101.4	100.2	100	.....	.....	
27	Pul.	.....	110	98	84	80	80	76	.....	.....	.....	Male, æt. 31; convalescent on 7th day.
	Tem.	.....	104	103.5	102 4	100.8	100	98.8	.....	.....	.....	
28	Pul.	110	80	94	82	98	.....	.....	.....	.....	.....	Adult male; black vomit. Death on 5th day.
	Tem.	103 8	104.5	103	101.8	101.8	.....	.....	.....	.....	.....	
29	Pul.	110	100.	84	90	92	90	80	104	114	114	Adult male; on the 9th temperature fell, pulse rose; death on 10th day.
	Tem.	103.8	104.4	103.7	103.6	102.2	101.8	102.2	102.2	102.2	98.5	
30	Pul.	118	116	104	100	98	100	.....	.....	.....	.....	Adult male; died on 7th day.
	Tem.	104.2	105.2	104.3	104.2	103	102.8	.....	.....	.....	.....	
31	Pul.	72	68	68	72	64	52	48	48	.....	.....	Male, æt. 19; jaundice the 3d day; convalescent the 9th.
	Tem.	101.3	102.2	101	101.5	99.8	100	99.8	99.3	.....	.....	
32	Pul.	108	100	108	94	80	70	70	60	50	44	Male, æt. 23; convalescent on 7th day.
	Tem.	fev.	102.2	103.8	102.2	100	100.4	98.5	96.8	96.8	.....	
33	Pul.	.....	.....	110	90	74	76	64	.....	.....	.....	Female child; convalescent on 7th day.
	Tem.	fev.	.....	104.5	102.6	102.8	100.8	99.6	.....	.....	.....	
34	Pul.	130	120	110	100	84	.....	.....	.....	.....	.....	Female; convalescent on 5th day.
	Tem.	102.2	104	104.6	102	99.4	.....	.....	.....	.....	.....	
35	Pul	.....	114	113	105	70	63	105	105	112	136	Adult male; jaundice the 4th day; black vomit the 6th; death on the 11th; with black vomit increase the pulse.
	Tem.	fev.	103.6	101.8	104.2	103	100.2	101 6	101.3	99.2	99.8	
36	Pul.	.....	120	100	90	74	72	68	78	90	80	Adult male; convalescent on 10th day.
	Tem.	fev.	105	105	103	102	102	101.5	102.8	101.1	100.2	
37	Pul.	.....	108	90	80	62	60	60	59	50	50	Male, æt. 27; convalescent the 8th day.
	Tem.	fev.	105.8	105.9	101.9	103.4	101.5	100	99.8	99.6	100.5	
38	Pul.	116	100	92	100	.....	....	.....	.....	.....	.....	Male, æt. 22; temperature fell the 5th day from 106.5 to 101.5; death on 5th day.
	Tem.	106.5	106.5	105	101.6	.....	.....	.....	.....	.....	.....	
39	Pul.	.....	85	96	110	.....	.....	.....	.....	.....	.....	Male, æt. 35; jaundice and black vomit; on the day of death, the 4th, temperature fell from 106.5 to 99.2; pulse rose from 84 to 172.
	Tem.	fev.	105.9	106.6	100	.....	.....	.....	.....	.....	....	
40	Pul.	.....	112	104	100	80	80	80	74	74	74	Male, æt. 20; jaundice on the 5th day, pulse becoming slow; temperature moderately high; convalescent the 14th day.
	Tem.	fev.	101.8	104	104	102.7	102.6	102.2	101	102.6	101.2	
41	Pul.	90	70	84	64	70	70	60	50	44	.....	Male child; veratrum lowers the pulse; convalescent the 10th day.
	Tem.	103	102	101.6	104.4	103.8	102.5	101	99.8	99	.....	

No. of Cases.	Temperature and Pulse.	1	2	3	4	5	6	7	8	9	10	Result and Remarks.
42	Pul.	.....	100	85	94	83	84	84	.....	.....	.....	Female, æt. 16; high temp. the 4th and 5th days; convalescent the 8th.
	Tem.	fev.	106	102	105	104.5	103.7	100	.....	.....	.....	
43	Pul.	98	80	76	70	74	84	108	.....	.....	.....	Male, æt. 40; jaundice the 3d day, with depressed pulse; death the 7th.
	Tem.	105.1	105.2	105	103.4	102.2	101.2	100.2	.....	.....	.....	
44	Pul.	.....	112	110	108	96	86	69	76	80	68	Male, æt. 32; jaundice and hemorrhage from kidneys; convalescent the 9th day.
	Tem.	fev.	105	104	102.2	102	102	101	101	99.2	99.8	
45	Pul.	.....	.....	.....	82	82	85	80	80	.....	.....	Male, æt. 37; jaundice the 3d day; albuminous urine; convalescence the 7th day.
	Tem.	fev.	fev.	fev.	100	100	100	98	98	.....	.....	
46	Pul.	.....	.....	.....	.....	.....	130	140	.....	.....	.....	Progressive diminution of urine; death on 7th day.
	Tem.	fev.	fev.	105	104	104	102.5	103.5	.....	.....	.....	
47	Pul.	.....	.....	80	72	80	80	.....	.....	.....	.....	Black vomit, jaundice, urinary suppression; death on 7th day.
	Tem.	fev.	fev.	101	101	100.8	101	.....	.....	.....	.....	
48	Pul.	.....	.....	84	92	80	.....	.....	.....	.....	.....	Black vomit, jaundice, urinary suppression; death on 6th day.
	Tem.	fev.	fev.	100.5	101	100	.....	.....	.....	.....	.....	

(b.)—HAENISH REPORTS THE FOLLOWING TEMPERATURES IN A CASE OF YELLOW FEVER AT SEA, FROM HAYTI TO VENEZUELA, MARCH 21, 1870. (FROM ZIEMSSEN'S CYCLOPÆDIA.)

Seaman, æt. 21, healthy; heart and respiratory organs normal.

Days.	Hours of Observation.	Temperature.	
1	8 A.M.	102.6° F.	Pulse quickening to 116-120; hydr. mite iv. gr.
	12 M.	102.8°	
	6 P.M.	103°	
2	8 A.M.	104.5°	Pultaceous stools; gums swollen; epigastric pains.
	12 M.	104.2°	
	6 P.M.	105°	
3	8 A.M.	104°	Vomits; jaundice appears; urine albuminous, bile pigment.
	12 M.	103.8°	
	6 P.M.	102.8°	
4	8 A.M.	101°	Jaundice increases; six or eight diarrhœal stools.
	12 M.	99.5°	
	6 P.M.	98.8°	
5	8 A.M.	101.2°	Apathy instead of restlessness; other symptoms subsiding.
	12 M.	101.5°	
	6 P.M.	102.8°	
6	8 A.M.	104°	Feels better; fever yet high; no vomiting; less epigastric sensibility.
	12 M.	103.5°	
	6 P.M.	102.8°	
7	8 A.M.	99.5°	With temperature lowering, perspiration at night; improved tongue and feelings.
	6 P.M.	99°	
8	A.M.	99.5°	Further improvements; convalescence with pulse at 80–84.
	P.M.	99.2°	

APPENDIX XV.

TEMPERATURE IN

CEREBRAL HEMORRHAGE,

By Charcot, Bourneville.

Time.	Rect. Temp.	Pulse.	Respir.	Remarks.
1. M. M. *æt.* 75.				Cer. Hem.
9 A.M.				First attack.
10 "	35.8	60	20—24	New attack.
11 "	36.3	120	" "	New attack.
12 "	35.8	128	28 "	New attack.
2 P.M.	37.2	100	20—24	Reaction.
5 "	38.6	96	20—24	
7 "	39.2	84	24—28	
9 "	40.4	120	24	
10.45				Death.
11 "	40.2			
1 "				
2. D. A., *æt.* 58.				Albuminuria.
5 P.M.	37.4	76	20—24	1st attack.
6	36	72	24—28	Hem. continues.
7	37.2	68	24	
10	37.9	60	28	
11	38	60	24	
12	39	64	24	
"	39—41.2			Fluct. during 46 h. Death at the highest figure. Hem. complic. with softening.
3. H. M., 1 h. after attack.	36.4			
2d, 3d, 4th h.	37—39.9			
5th h. to	37.1			Abortive reaction.
19th h.	37.2			Death. (*)

SOFTENINGS OF THE BRAIN,

By Bourneville, Joffroy.

Time.	Rect. Temp.	Pulse.	Respir.	Remarks.
1. C. M., *æt.* 86.				Red softening; right facial paralysis; contracture; inequality of temperature both sides.
1st day 10 A.M.	36.6	72	24	
" 2 P.M.	36.8	72	24	
Evening.	37.6	68	28	
2d day 1 P.M.	37.9	78	32	
" 2 P.M.	38.2	86	32	
" 6 P.M.	38.2	96	36	
3d day A.M.	40	132	52	
" 1 P.M.	40.4			A few minutes after death.
2. G. M., *æt.* 74.				White softening; paralytic attack; loss of speech, not of consciousness; no convulsions.
1st day even.	36.8	124	24	
2d " morn.	37.8	108	30	
" " even.	38.2	120	38	
3d " morn.	37.8	96	..	
" " even.	38.4	124	36	
4th " morn.	38.6	136	..	
" " even.	39.2	148	48	
5th " morn.	40.4			At death.
	40.2			20 min. later.
3. B. I., *æt.* 85.				Softening of the whole gray substance; no loss of speech nor of consciousness.
1st day morn.	36.6			
" " even.	36.6			
2d day morn.	38.6		28	
" " even.	38.3	104		
3d day morn.	38.6		32	
" " even.	39.6			
4th day morn.	42.6			Soon after death.

* This case is the only one out of 17 of cerebral hemorrhage, who died in the thirties. The 16 others showed at death, or sometimes before or after, from 40° to 42.8° C. On the other hand, the temperature in 21 cases a short time after the attack was in the thirty-sevenths five times, in the thirty-sixths twelve, and in the thirty-fifths four times; the greatest excursus between the hemorrhagic and the agonic temperature being 7.4° C.

APPENDIX XVI.

(a.)—TEMPERATURE IN NINETEEN CASES OF INSANITY.

120 Observations expressly made for this book by Dr. Ch. Langdon, in the Hudson River State Hospital, New York (Dr. Kellogg, Superintendent).

DEMENTIA.

CASE NO. 1.—Man, 24 years of age; 2 years' standing.

DAY.	PULSE.	TEMP.	DAY.	PULSE.	TEMP.
1st	84	98.5° F.	6th	80	98.5° F.
2d	78	98.75° "	7th	72	98.5° "
3d	84	98.5° "	8th	80	98.5° "
4th	74	98.5° "	9th	84	98.5° "
5th	80	98.5° "	10th	60	98.5° "

CASE NO. 2.—Man, 31 years; 7 years' standing.

DAY.	PULSE.	TEMP.	DAY.	PULSE.	TEMP.
1st	72	98.5° F.	6th	80	98.5° F.
2d	82	98.5° "	7th	92	98.5° "
3d	92	98.5° "	8th	84	98 5° "
4th	80	98.5° "	9th	84	98.5° "
5th	92	98.5° "	10th	84	98.5° "

CASE NO. 3.—Man, 41 years old; 4 years' standing.

DAY.	PULSE.	TEMP.	DAY.	PULSE.	TEMP.
1st	84	98.5° F.	6th	88	98.75° F.
2d	84	98.5° "	7th	84	98.5° "
3d	84	98.5° "	8th	80	98.5° "
4th	74	98.5° "	9th	84	98.5° "
5th	84	98.75° "	10th	84	98.5° "

CASE NO. 4.—Man, 2 years' standing; 32 years.

DAY.	PULSE.	TEMP.	DAY.	PULSE.	TEMP.
1st	96	98.5° F.	6th	88	98.5° F.
2d	96	98.5° "	7th	92	98.5° "
3d	90	99° "	8th	96	98.5° "
4th	92	98.5° "	9th	90	98.5° "
5th	90	98.5° "	10th	92	98.5° "

SUBACUTE MANIA.

CASE NO. 1.—Man, 40 years; 1 year's standing.

DAY.	PULSE.	TEMP.	DAY.	PULSE.	TEMP.
1st	84	98.5° F.	6th	80	98.75° F.
2d	86	98.75° "	7th	88	98.75° "
3d	84	98.75° "	8th	84	98.75° "
4th	78	98.5° "	9th	84	98.75° "
5th	80	98.75° "	10th	84	98.75° "

CASE NO. 2.—Man, 7 months' duration.

DAY.	PULSE.	TEMP.	DAY.	PULSE.	TEMP.
1st	84	99° F.	6th	84	98.5° F.
2d	84	99° "	7th	84	98.5° "
3d	84	98.5° "	8th	84	98.5° "
4th			9th	84	98.5° "
5th	84	98.5° "	10th		

CHRONIC MANIA.

CASE No. 1.—Man, 50 years; 4 years' standing.

DAY.	PULSE.	TEMP.	DAY.	PULSE.	TEMP.
1st	90	98.75° F.	6th	84	98.5° F.
2d	90	98.5° "	7th	88	98.5° "
3d	88	98.5° "	8th	88	98.5° "
4th	84	98.5° "	9th	84	98.5° "
5th	74	98.5° "	10th	78	98.5° "

CASE No. 2.—Man, 30 years; 3 years' duration.

DAY.	PULSE.	TEMP.	DAY.	PULSE.	TEMP.
1st	84	98.75° F.	6th	74	98.75° F.
2d	84	98.5° "	7th	78	98.5° "
3d	84	98.5° "	8th	74	98.5° "
4th	80	98.5° "	9th	80	98.5° "
5th	88	98.5° "	10th	84	98.5° "

EPILEPTIC MANIA. (?)

CASE No. 1.—Man, 74 years; 2 years' duration.

DAY.	PULSE.	TEMP.	DAY.	PULSE.	TEMP.
1st	78	98.5° F.	6th	78	98.5° F.
2d	78	98.5° "	7th	78	98.5° "
3d	80	98.5° "	8th	78	98.5° "
4th	78	98.5° "	9th	78	98.5° "
5th	76	98.5° "	10th	78	98.5° "

INSANITY FROM ALCOHOLISM.

CASE No. 1.—Man, 27 years; 6 months' duration.

DAY.	PULSE.	TEMP.	DAY.	PULSE.	TEMP.
1st	72	98.5° F.	6th	80	98.5° F.
2d	84	99° "	7th	84	98.75° "
3d	84	99° "	8th	90	98.5° "
4th	84	98.75° "	9th	84	98.5° "
5th	72	98.75° "	10th	84	98.75° "

CASE No. 2.—Man, 40 years; 3 months' duration.

DAY.	PULSE.	TEMP.	DAY.	PULSE.	TEMP.
1st	96	99° F.	6th	84	98.75° F.
2d	90	99.25° "	7th	90	98.5° "
3d	90	98.75° "	8th	84	98.5° "
4th	80	98.5° "	9th	84	99° "
5th	96	98.75° "	10th	88	99° "

GENERAL PARESIS.

CASE No. 1.—Man, 40 years old; 3 months' duration.

DAY.	PULSE.	TEMP.	DAY.	PULSE.	TEMP.
1st	90	99° F.	6th	84	98.75° F.
2d	96	99° "	7th	84	98.75° "
3d	96	99.25° "	8th	80	99° "
4th	96	99° "	9th	88	99° "
5th	88	99.50° "	10th	90	90° "

Patient is up in the ward. Very exalted delusions. Paresis *very slight*.

CASE NO. 2.—Man, 35 years old; 1 year's duration.

DAY.	PULSE.	TEMP.	DAY.	PULSE.	TEMP.
1st	60	98° F.	6th	66	98° F.
2d	60	98° "	7th	60	98.50° "
3d	60	98° "	8th	60	98° "
4th	66	98° "	9th	80	98.75° "
5th	70	98° "	10th	88	98.50° "

Patient is now in bed. Paresis well marked. Bed-sores over sacrum and hips. Cries and groans much of the time. Does not talk.—See also case on p. 10.

ACUTE MANIA.

CASE NO. 1.—Man, 40 years old; 1 month's duration.

DAY.	PULSE.	TEMP.	DAY.	PULSE.	TEMP.
1st	84	98.75° F.	6th	88	99° F
2d	94	100° "	7th	84	98.5° "
3d	84	98.75° "	8th	84	99° "
4th	75	98.75° "	9th	80	99° "
5th	88	99° "	10th	80	99° "

CASE NO. 2.—Man, 21 years old; 1 week's duration.

DAY.	PULSE.	TEMP.	DAY.	PULSE.	TEMP.
1st	84	100° F.	4th	84	98.5° F.
2d	84	100° "	5th	84	98.5° "
3d	96	99° "	6th	88	98.75° "

CASE NO. 3.—Man, 22 years old; 2 days' duration.

DAY.	PULSE.	TEMP.	DAY.	PULSE.	TEMP.
1st	92	99.5° F.	5th	92	99.5° F.
2d	92	99.5° "	6th	96	98.75° "
3d	92	99° "	7th	88	98.75° "
4th	84	99° "			

The cases of melancholia on the male side are all old cases, and are now really more demented than anything else.

MELANCHOLIA.

CASE NO. 1.—Man, 47 years old; 14 years' duration.

DAY.	PULSE.	TEMP.	DAY.	PULSE.	TEMP.
1st	72	98.5° F.	6th	78	98.5° F.
2d	66	98.5° "	7th	80	98.5° "
3d	84	98.5° "	8th	78	98.5° "
4th	66	98.5° "	9th	78	98.75° "
5th	75	98.5° "	10th	74	98.5° "

CASE NO. 2.—Man, 43 years old; 4 years' duration.

DAY.	PULSE.	TEMP.	DAY.	PULSE.	TEMP.
1st	90	98.5° F.	6th	70	98.5° F.
2d	84	99° "	7th	84	98.5° "
3d	90	98.5° "	8th	90	98.5° "
4th	70	98.5° "	9th	70	98.5° "
5th	70	98.5° "	10th	70	98.5° "

GENERAL PARESIS.

CASE NO. 3.—Man, 43 years old; 7 months' duration.

DAY.	PULSE.	TEMP.
1st	....90, small and feeble	....98.5° F.
2d	....90, " "	....98.5° "
3d	....96, " "	....98.25° "
4th	....90, " "	....98.5° "
5th	....90, " "	....98.5° "
6th	....94, small and feeble	....98.5° F.
7th	....90, " "	....98.25° "
8th	....90, " "	....98.5° "
9th	....90, " "	....98.5° "
10th	...90, " "	....98.5° "

This patient is up on ward. Quiet. Paresis moderately marked. Grasp rather weak. Staggers in walk. Slight stuttering when talking. There are no instruments of precision here; if they were, I would give a more complete account of his case. His case should come *between* the 1st and 2d (under the head of General Paresis).

(b.)—TEMPERATURE IN INSANITY, SUMMED UP FROM THE PRECEDING OBSERVATIONS MADE BY DR. CH. LANGDON.

Disease.	Case.	Age.	Duration.	Decade of Pulse.	Decade of Temper.	Average of Pulse.	Average of Temper.
Acute mania	1	40	1 m.	841	989.75	87.1	99.02
	2	21	1 w.	864	901.00		
	3	22	2 d.	906	991.00		
Sub-acute mania	1	40	1 y.	832	987.00	83.6	98.66
	2	..	7 m.	840	986.25		
Chronic mania	1	50	4 m.	844	985.00	82.7	98.68
	2	30	3 y.	810	988.50		
Epileptic mania	1	74	2 y.	780	987.00	78	98.70
Alcoholic insanity	1	27	6 m.	818	987.00	85	98.70
	2	40	3 m.	882	987.00		
General paresis	1	35	1 y.	670	981.75	67	98.20
	2	40	3 m.	892	990.25	90	98.70
	3	43	7 m.	910	984.50		
Melancholia	1	47	14 y.	751	985.25	76	98.37
	2	43	4 y.	788	985.50		
Dementia	1	24	2 y.	776	985.25	84.2	98.55
	2	31	7 y.	842	985.00		
	3	41	4 y.	830	985.50		
	4	32	2 y.	922	986.50		

APPENDIX XVII.

(*a*).—TEMPERATURE IN IDIOCY.

33 Observations taken by Dr. John Van Duyn, in the New York State Asylum for Idiots, Syracuse, N. Y. (Dr. H. B. Wilbur, Superintendent).

Reg. No.	*Observations taken about 9 o'cl. a.m., 3 p.m., and 8 to 9 p.m.*	T.	P.	R.	T.	P.	R.	T.	P.	R.
413	Æt. 14. Boy. Slightly deficient.	99° 99.8° 98.3°	64 84 76	14 26 17	99.9° 99.6° 98.5°	74 66 91	20 18 15	99.8° 100° 98.3°	78 86 91	21 25 17
312	Æt. 17. Girl. Slightly deficient; very nervous.	99.5° 99.25° 98.4°	89 80 72	22 23 22	98.6° 99.3° 98.25°	76 83 70	24 26 21	99.5° 99° 98.1°	88 72 74	20 23 22
453	Æt. 15. Girl. Slightly deficient; congenital chorea.	99.5° 100.2° 99°	64 64 76	24 18 17	99.6° 99.6° 98.8°	62 64 66	20 20 16	99.6° 99.4° 99°	66 66 60	20 20 18
423	Æt. 14. Boy. Periodical insanity; paralysis of left side of face.	100.1° 100.3° 98.3°	86 84 66	25 21 22	100° 100° 97.8°	84 82 74	27 28 19	99.7° 100.1° 98.1°	74 83 77	21 24 14
409	Æt. 14. Boy. Paralysis of left side from fits when two years; occasional convulsions yet.	100.2° 100.4° 97.6°	84 86 64	12 14 12	100.3° 100.1° 97.8°	74 76 74	14 18 16	100.5° 100° 98°	84 79 62	18 14 13
257	Æt. 19. Boy. Congenital idiocy, with some deafness.	99.5° 99.8° 97.5°	73 84 74	18 15 16	100° 99.1° 97.75°	76 70 64	17 16 13	99.5° 99.5° 97.75°	78 72 76	16 17 12
477	Æt. 12. Boy. Quite intelligent, but alternately depressed and exalted.	99.9° 100.2° 98.1°	64 80 54	23 30 18	100.3° 99.5° 98°	72 64 54	32 23 16	99.9° 100.2° 97.8°	56 61 50	24 14 12
346	Æt. 19. Boy. Medium grade.	99.3° 100° 97.25°	62 58 53	16 11 12	99.6° 99.4° 97.5°	52 56 42	14 14 10	99 5° 99.4° 97.3°	64 48 42	16 16 11
419	Æt. 15. Boy. Medium grade; infantile convulsions persisting.	99.7° 100.2° 98.2°	82 84 68	20 18 16	99.9° 99.25° 97.8°	76 72 80	20 21 15	99.75° 99.8° 97.7°	82 73 76	20 22 16
462	Æt. 10. Congenital idiocy.	99.7° 100.2° 98.75°	62 72 57	22 20 16	100° 100.3° 98.75°	72 68 61	19 20 16	99.3° 100.6° 98.4°	66 76 60	20 20 16
395	Æt. 14. Girl. Medium grade; very excitable.	99.5° 100.2° 97.5°	94 100 100	32 32 20	99.7° 99.2° 97.8°	78 94 78	32 34 24	99° 100° 98.1°	92 102 62	32 31 24
470	Æt. 12. Girl. Congenital idiocy.	99.75° 100.1° 98.3°	72 88 82	24 24 20	99.6° 99.7° 99°	68 72 60	24 24 24	100.2° 99.5° 98.25°	78 64 74	24 32 23
420	Æt. 17. Girl. Insane.	100° 100.2° 97.5°	101 102 86	22 26 21	99.8° 100.1° 97.75°	88 108 78	24 22 18	99.5° 99.75° 98°	100 98 82	20 27 21

Reg. No.	*Observations taken about 9 o'cl. a.m., 3 p.m., and 8 to 9 p.m.*	T.	P.	R.	T.	P.	R.	T.	P.	R.
388	Æt. 16. Boy. Microcephaly of a low grade.	99.3° 99.3° 99.6°	72 78 66	20 19 13	99.7° 99.5° 98°	100 74 90	20 22 14	99.3° 99° 97.6°	78 78 74	19 16 18
279	Æt. 20. Boy. Medium.	99.7° 99.6° 97.1°	94 92 76	16 18 14	99.6° 99.75 97.75	94 90 89	19 18 16	99.7° 99.5° 97.3°	94 94 75	16 19 15
449	Æt. 12. Girl. Medium.	99.3° 99° 98.6°	84 86 68	20 20 16	99.5° 100° 98.6°	84 84 72	21 16 16	99.5° 99.25° 99.1°	88 90 74	20 18 14
402	Æt. 17. Boy. Medium.	100° 100.3° 98.8°	70 83 65	24 24 23	99.1° 99.3° 97.8°	67 63 58	24 24 17	99.75° 98.8° 98.25°	64 52 55	22 20 18
380	Æt. 17. Boy. Idiot of a low grade.	99.4° 99.2° 97.8°	68 72 72	21 22 17	99.8° 99.25° 97.8°	76 72 68	22 21 20	98.8° 98.8° 97.6°	68 72 67	22 24 20
391	Æt. 15. Boy. Demented.	99.6° 99.7° 98°	53 50 46	14 12 11	99.5° 99.4° 97.6°	58 49 45	13 12 14	99.4° 99.7° 97.8°	52 49 46	16 14 12
384	Æt. 11. Boy. Periodic insanity.	101.25° 99.8° 97.5°	80 69 62	22 20 16	101.1° 99.75° 97.5°	88 68 68	18 18 24	100.3° 100.25° 97.4°	72 82 72	19 21 18
466	Æt. 8. Girl. Idiot of a low grade.	101.3° 99.7° 98.25°	106 88 100	26 23 16	99.9° 99.8° 97.9°	100 82 86	18 24 16	99.8° 100.2° 98.25°	88 96 92	20 21 14
	Æt. 10. Girl. Idiot of a low grade.	100.5° 100.1° 99.4°	90 90 86	24 22 22	100.5° 100.5° 99.25°	96 90 90	22 22 16	99.5° 100.25° 99.2°	94 92 80	19 22 18
	Æt. 10. Boy. Idiot of a low grade.	99.75° 100.25° 98.8°	88 86 96	18 22 19	100.25° 100.2° 99°	88 88 72	22 22 20	100.25° 99.9° 98.3°	93 82 64	20 21 16
	Æt. 17. Girl. Idiot of a low grade.	99.25° 99.9° 98.5°	86 100 100	22 22 20	100° 99.6° 99°	112 112 108	18 15 11	99.8° 99.6° 98.75°	112 112 94	13 13 16
	Æt. 17. Boy. Idiot of a low grade.	102.2° 99.5° 98.25°	74 69 58	17 16 12	99.75° 99.75° 98°	74 75 76	17 16 14	100.25° 100.25° 98.1°	79 82 68	17 18 14
	Æt. 11. Boy. Idiot of a low grade.	100.4° 100° 98.2°	93 81 66	13 20 14	100.5° 100.1° 98.5°	99 72 84	23 21 20	100° 100° 98.5°	90 79 70	24 18 16
	Æt. 20. Girl. Idiot of low grade.	99.5° 99.25° 98.5°	90 78 96	12 16 22	99.3° 100. 99.2°	84 92 94	14 15 22	99.7° 100.2° 99°	72 84 88	16 30 18
	Æt. 10. Boy. Idiot of low grade.	99.25° 99.75° 97.5°	64 78 60	14 10 12	98.75° 99.75° 98.25°	64 82 76	12 14 15	99.2° 99.5° 96.6°	90 84 62	13 14 11
	Æt. 12. Boy. Idiot of the lowest grade.	100.3° 100.6° 98.25°	86 94 81	22 21 18	100.2° 100.5° 98.5°	84 90 70	19 21 16	100.6° 100.4° 98.25°	80 94 84	26 24 16

Reg. No.	*Observations taken about 9 o'cl. a.m., 3 p.m., and 8 to 9 p.m.*	T.	P.	R.	T.	P.	R.	T.	P.	R.
	Æt. 15. Boy. Idiot of the lowest grade.	100.4° 100.4° 98.25°	101 82 86	14 22 20	100.8° 100.4° 98.8°	94 96 78	16 20 20	100.5° 100.5° 98.3°	92 81 93	16 20 20
	Æt. 22. Girl. Hydrocephaly.	98.3° 99.6° 98.3°	84 76 69	18 18 17	99.5° 99.7° 98.4°	78 84 66	21 23 14	99.7° 99.3° 98.1°	73 84 66	18 18 14
	Æt. 15. Boy. Medium idiot.	99.3° 99.5° 99°	55 50 59	21 22 21	100.25° 100° 98.6°	70 57 52	22 23 17	99.7° 99.4° 98.4°	60 57 50	20 24 19
	Æt. 11. Girl. Idiot of low grade.	99.4° 100.1° 97.2°	68 74 64	12 12 12	100.6° 100.2° 97.5°	74 84 56	7 17 13	100.3° 100.1° 97.8°	60 58 70	21 7 12

(*b.*)—TEMPERATURE OF SIX CRETINS, TAKEN BY DR. JOHN VAN DUYN, SURGEON OF THE NEW YORK STATE ASYLUM FOR IDIOTS, SYRACUSE, N. Y.

		T.	P.	R.	T.	P.	R.	T.	P.	R.	T.	P.	R.	T.	P.	R.	T.	P.	R.
Girl, æt. 15, of medium intelligence.	8 a.m.	99.75°	82	18	100.5°	76	23	100°	72	22	99.75°	72	20	99.7°	68	19	100°	66	18
	2 p.m.	99.75°	72	20	99.7°	66	19	99.25°	66	22	100°	68	21	99°	65	19	99.25°	66	18
	9 p.m.							98.25°	68	20	99.6°	72	20	98.8°	67	22			
Girl, æt. 10, of medium intelligence.	8 a.m.	99.5°	82	24	98.8°	76	28	98°	84	19	98°	86	28	99.25°	92	26	99.25°	100	24
	2 p.m.	99.5°	86	32	98.8°	78	26	99.5°	84	25	99.5°	90	21	100.3°	88	26	99.8°	74	24
	8 p.m.	98°	68	22	97.3°	62	21	98°	64	21	98°	82	22	99.5°	90	22			
Girl, æt. 10, of ordinary intelligence.	8 a.m.	99.5°	90	18	99.7°	92	23	99.7°	94	21	99.3°	82	14	100°	92	21	100.25°	92	20
	2 p.m.	99.7°	88	23	99.8°	104	23	100°	94	20	100.2°	98	22	100.5°	100	20	99°	104	18
	8 p.m.	98.3°	80	18	97.7°	74	14	98.2°	78	14	100°	100	20	99.7°	94	21			
Boy, æt. 15, of medium intelligence.	8 a.m.				99.25°	98	23	99.7°	95	24	100.3°	96	36						
	2 p.m.	101.25°	102	28	101.25°	90	30	101°	98	26	103°	106	36						
	8 p.m.	100.5°	102		100.5°	103	19	100.1°	90	22	101.3°	100	30						
Boy, æt. 14, of medium intelligence.	8 a.m.	99.7°	90	25	100°	86	25	100.5°	86	26	99.75°	82	25	100.2°	74	27	100.7°	78	28
	2 p.m.	100.4°	82	24	100.5°	80	26	100.5°	84	25	101.6°	100	30	100.4°	84	35	100.2°	75	28
	8 p.m.	98.7°	86	26	99.25°	82	18	98.75°	82	24	98.8°	75	26	98.5°	76	28			
Boy, æt. 9, of ordinary intelligence.	8 a.m.				99.5°	70	23	99.6°	77	20	99.7°	79	24	100.5°	86	22	99.5°	78	20
	2 p.m.	100.1°	86	25	99.75°	76	24	99.75°	78	22	99.3°	86	22	99.8°	78	22	100°	72	25
	8 p.m.	99.3°	74	25	98.2°	76	19	98.5°	70	22	99°	86	19	99.6°	82	27			

APPENDIX XVIII.

SUM OF THE EXPERIMENTS OF POCHOY ON THE EFFECTS OF INJURIES AT DIFFERENT POINTS OF THE SPINE ON THE CENTRAL TEMPERATURE.

1.—On a female cobaye. Section of some nerves of the cauda equinis at...... 38.7°
Gradually falling four hours after.................................... 33.6°
Thence rising till the tenth hour...................................... 40.4°
Then the subject was killed by its mate.

2.—Cobaye. Section of medulla above the lumbar enlargement at............ 38.2°
Gradually falling till 2 hours 25 minutes after operation................ 34.2°
Reascending till the fourth and fifth hour respectively........... 39.5°, 38.2°
Death in the night.

3.—Rabbit. Crushing of the medulla in the dorsal region at .... 39.2°
Lowest temperature during the ten following hours .... 37°

4.—Cobaye. Section of the part of the dorsal enlargement at................ 38.9°
Successive falls during two days to 36°, 34°, 30°, 19°: death at......... 16°

APPENDIX XIX.

(*a*.)—ROGER'S EIGHT CASES OF LOCAL APYREXY BY GANGRENE OF THE MOUTH.

No.	Date.	Age.	Respiration.	Pulse.	Temperature. Mouth.	Temperature. Axilla.	Observations.
I.	22 Sept.	3 years.	40	140		40°	Gangrene of the mouth the 6th day, following rubeola. Death.
II.	20 March.	4 years.	36	132		39.50°	Do. 3d day. Left
	21 "	"	52	140		39.50°	pneumonia of the
	22 "	"	64	160		39°	base.
	23 "	"	60	138		38°	Death.
	24 "	"	72	138		38°	Do. after erratic
III.	18 June.	9 years.	28	120		39°	erysipelas.
IV.	5 Oct.	4 years.	48	128	39°	axilla.	
					39°	mouth.	Do. 6th day following rubeola.
					37.25°	sick cheek.	
					36°	well cheek.	
	8 "				36.75°	sick cheek.	
					36°	well cheek.	
	11 "		26	112	36.25°	sick cheek.	
					35.50°	well cheek.	
	14 "		28	90	37.25°	axilla.	
					37.65°	mouth.	
					35.50°	sick cheek.	
					34.50°	well cheek.	Cure.
V.	20 March.	4 years.	26	128	38.50°	axilla.	Do. after varioloid.
	22 "				38°	axilla.	

No.	Date.	Age.	Respiration.	Pulse.	Temperature. Mouth. Axilla.	Observations.
VI.	17 May.	14 years.	28	74	37.25° sick surface. 36.75° well surface.	Pseudo-membranous stomatitis. Gangrene.
	17 June.		34	112	37.75° axilla. 38.25° on the slough.	
	19 "		24	76	35.50° axilla. 36° on the slough.	Death.
VII.	16 Oct.	(*Ext. temp.* 16.50° *C.*)			27° centre of the " 33° cheek near slough. 32.50° healthy cheek.	Do. Death.
VIII.	24 July.	2½ y'rs.	144		38.6° sick spot. 37.6° other cheek.	Do.

Dr. Roger concludes from these observations that the centre of the slough is the seat of frigeration, whilst the adjacent tissues are kept in a state of inflammation by the efforts of the *vis eliminatrix*. (The local frigeration is more marked yet in *gangrena senilis.*)

(*b.*)—ROGER'S TWENTY-NINE CASES OF GENERAL APYREXY BY SCLEROSIS.

No. of Observation.	Date.	Age.	Respir.	Pulse.	Temperature (Centigrade).	Remarks.
I.	Oct. 18	60 hours.	50	96	Axilla, 33° Arm's fold, 32°	Mild œdema.
	" 19	"	32	72	" "	More marked.
	" 21	"	"		Axilla, 22° Hand, 21°	Extreme congestion of both lungs; death.
II.	" 24	48 hours.	21	88	" 22.5°	Mild œdema; dead Sub-arachnoidean hemorrhage.
III.	Mar. 23	5 days.	32	84	" 28°	Well-marked œdema; icterus; congestion of both lungs.
	" 27	......	16	60	Axilla, 23.5° Mouth, 22°	Death in the afternoon.
IV.	Oct. 18	8 days.	14	72	" 24.5°	Well-marked œdema; pulmo. congestion; death in 19 hours.
V.	" 26	7 days.	"	"	" 25°	Much œdema; pulm. congest.; agony.
VI.	" 28	at birth.	"	"	" 25.5°	Œdema; death.
VII.	Mar. 27	8 days.	20	60	Axilla, 25.5° Mouth, 24°	Marked œdema; pulm. congest.; death.
VIII.	Oct. 19	5 days.	30	78	Axilla, 32.3° Mouth, 24°	Light œdema.
	" 21	"	22	78	" 28.25°	Light œdema.
	" 23	"	20	72	" 36.5°	Excessive œdema; pulmonary congest.
	" 24	"	"	"	24°	Death in 13 hours.

No. of Observation.	Date.	Age.	Respir.	Pulse.	Temperature (Centigrade).		Remarks.
IX.	Dec. 6	1 day.	"	"	Axilla,	32.5°	Light œdema.
					Arm's fold,	32°	
					Hand,	29.75°	
					Foot,	25°	
	" 7	"	"	"	Axilla,	28°	Well-marked œdema.
					Arm's fold,	27°	
					Hand,	26°	
					Foot,	25.5°	
	" 8	"	"	"	Axilla,	27°	Excessive œdema.
					Arm's fold,	26°	
					Hand,	25.5°	
					Foot,	24°	
	" 9	"	"	"	Axilla,	26°	Agony.
					Arm's fold,	25.75°	
					Hand,	24.75°	
					Foot,	24°	
X.	Mar. 28	5 days.	"	"	Axilla,	27°	Mild œdema of two days
					Mouth,	26°	Death three days after.
XI.	Oct. 19	6 days.	36	96		32.5°	Mild œdema.
	" 21	......	18	88		29°	Do.
	" 22	......	"	"		27.75°	Do.
	" 23	......	18	80		28.25°	Well marked œd.; pulm. congest.; death.
XII.	" 26	5 days.	28	70	Axilla,	28.5°	Marked œdema; death.
					Hand,	26.5°	
XIII.	Mar. 23	7 days.	36	96		28.5°	Marked œdema; death.
XIV.	" 17	7 days.	36	92		32°	Marked œdema; icterus.
	" 18	......	32	72		30°	Do., pulm. congest.; death.
XV.	April 1	3 days.	26	72	Axilla,	32°	Œdema; icterus; death.
					Mouth	29.5°	
XVI.	Mar. 11	5 days.	28	124		32°	Œdema; icterus; pul. congest.; death.
XVII.	" 11	"	40	78		32°	Light œdema.
XVIII.	" 24	2 days.	40	108		32°	Œdema; death.
XIX.	" 27	3 days.	40	76		32.5°	Mild œdema of three days cured the fourth day.
XX.	Dec. 6	6 days.	"	"	Axilla,	33°	Marked œdema.
					Arm's fold,	32.5°	
					Foot,	31°	
					Hand,	29°	
	" 7	"	"	"		33°	Do.
	" 8	"	"	"		34.5°	Less; cured the ninth day.
XXI.	Mar. 31	5 days.	32	108	Axilla,	33°	Light œdema; icterus; death.
					Mouth,	30.5°	
XXII.	" 17	9 days.	52	124		34°	Light œdema; death.
XXIII.	" 15	2 days.	59	88		35.75°	Light œdema.
	" 17	"	48	124		34°	More marked; icterus.
	" 21	......	"	120		35.75°	Pulm. congest.; death.
XXIV.	"	4 days.	26	88		35°	Light œdema; death.
XXV.	Mar. 27	2 days.	34	104		35°	
XXVI.	" 17	7 days.	38	96		37°	Light œdema; bronch.
	" 23	......	32	132		36°	Very light œd.; bronch.
	" 25	......	32	140		36.25°	Do. Do.
	" 27	......	48	112		35.5°	Do. Death 3 days later.
XXVII.	" 14	3 days.	54	88		36°	Light œdema.
	" 20	"	34	124		35.5°	Icterus.
	" 21	"	32	120		36.5°	Death.
XXVIII.	" 25	4 days.	60	132		36.25°	Œdema; icterus.
	" 27	"	42	104		36.75°	Enteritis; death.
XXIX.	" 17	3 days.	52	128		37°	Thrust; death.

APPENDIX XX.

TABLE OF TEMPERATURE DURING THE ASCENSIONS OF MONT BLANC.

(17th and 28th August, 1869.)

BY LEURTET.

Place.	Height.	At the first ascension.			At the second ascension.		
		Temperature of air.	Temperature of body resting.	Temperature of body walking.	Temperature of air.	Temperature of body resting.	Temperature of body walking.
	METRES. YARDS	CENT. FAHR.	CENT. FAHR.	CENT. FAHR.	CENT. FAHR.	CENT. FAHR.	CENT. FAHR.
Lyons....................	200 = 219	22.7° = 72.86°	36.4° = 97.52°	36.2° = 97.16°	....	....	....
Chamounix............	1050 = 1148	10.1° = 50.18°	36.5° = 97.7°	36.3° = 97.34°	12.4° = 54.32°	37° = 98.6°	35.3° = 95.54°
Cascade du Durd........	1500 = 1640	11.2° = 52.16°	36.4° = 97.52°	35.7° = 96.26°	13.4° = 56.12°	36.3° = 97.34°	34.3° = 93.74°
Chalet de la Para........	1605 = 1755	11.8° = 53.24°	36.6° = 97.88°	34.8° = 94.64°	13.6° = 56.48°	36.3° = 97.34°	34.2° = 93.56°
Pierre Perdue...........	2049 = 2240	13.2° = 55.76°	36.5° = 97.7°	33.3° = 91.94°	14.1° = 57.38°	36.4° = 97.52°	33.4° = 92.12°
Grands Mulets..........	3050 = 3336	— 0.3° = 31.46°	36.5° = 97.7°	33.1° = 91.58°	— 1.5° = 29.30°	36.2° = 97.16°	33.3° = 91.94°
Grand Plateau..........	3932 = 4300	— 8.2° = 17.24°	36.6° = 97.34°	32.8° = 91.04°	— 6.4° = 20.48°	36.7° = 98.06°	32.5° = 90.5°
Bosses du Dromadaire...	4556 = 4973	— 10.3° = 13.46°	36.4° = 97.52°	32.2° = 89.96°	— 4.2° = 24.44°	35.7° = 96.26°	32.3° = 90.14°
Sommet du Mt. Blanc...	4810 = 5260	— 9.1° = 15.62°	36.3° = 97.34°	32° = 89.6°	— 3.4° = 25.88°	36.6° = 97.88°	31.8° = 89.24°

APPENDIX XXI.

CLINICAL TABLE OF SYMPTOMS,

CORRESPONDING BY DAYS AND SEPTENARIES TO THE TABLE OF THE THREE GREAT VITAL FUNCTIONS.

Days of the Malady								Septenary No.	
								Sum.	Average.
Urine. Frequency, quantity (*)									
Gravity, reaction									
Couleur claire ou trouble									
Albumine. Sugar, urea									
Microscopic sediments. Salts									
Evacuations, number, character									
Transpiration, exhalation. Hemorrhages									
Agitation, delirium. Sleep, coma									
Drinks and food									
Medication									
Daily weight (**)									

* The urinals must be of strong glass, and graduated.

** Each ward must have at least a weighing bed and a weighing chair.

These tables and the others contained in this book may be had by the hundreds or thousands, of W. Wood & Co., 27 Great Jones Street, and G. P. Putnam's Sons, corner 4th Avenue and 23d street, New York, and wherever clinical thermometers can be procured.

APPENDIX XXII.

MEETING OF THE AMERICAN MEDICAL ASSOCIATION.

Dr. E. Seguin on the Brussels International Convention—Importance of American Representation—Scientific Object of the Delegation.

LOUISVILLE, KY., May 5

To the American Medical Association.

MR. PRESIDENT AND GENTLEMEN: You have twice sent delegates to the British Medical Association and kindred European societies, to invite them to concert a plan of uniformity of methods, instruments, scales, and records for clinical observations. This proposition has become more opportune since the meeting in Paris of the convention for the adoption of uniform weights and measures by all nations, in which convention Profs. Henry and Hilgen represented the United States, but in which the special wants of unity of measures in our profession was not considered. This uniformity of means of observation is advocated by Sir William Jenner, W. Reynolds, Sibson, Stewart, Squire, Sidney Ringer, Wilson and Tilbury Fox in England, and on the Continent by MM. Marey, Charcot, Lorain, Potain, Lepine, Ollier, Chauveau, and other distinguished physicians, all ready to open a commission in Paris and a sub-commission in Lyons, in order to concur in your plan of uniform observations. This plan embraces the unity of clinical thermometer and of the thermometric scales, charts, etc., a uniform graduation of the sphygmograph, myograph, spyrograph, æsthesiometer, manometer, globulimeter, ophthalmoscope, thermoscope, and other instruments of precision used in diagnosis; a uniform method of measuring and registering the hearing, the sight, and the velocity of other sensory impressions; the regularity of co-ordinate movements, as the walk; and a uniform registration of all clinical cases according to their kind. Of this plan the International Medical Congress, meeting at Brussels the 19th of September proximo, proposes to carry out only one part, the uniform measurement and record of hearing by all nations. It is therefore important that the American Medi-

cal Association be represented this year at Brussels, in order to present and urge there the adoption of our original plan of uniformization of clinical observation in its integrity and entirety.

Dr. Seguin then offered the following resolution:

Therefore, the American Medical Association resolve to nominate new delegates commissioned to again advocate in Europe the unity of clinical observation, and charge them to report in brief at the next meeting in 1876.

In accordance with these conclusions, the following gentlemen were appointed delegates to the International Medical Convention at Brussels, to the British Medical Association, to the French, German, and other kindred societies: Drs. I. A. Adrian, I. C. Hutchison, I. C. Huff, E. C. Harwood, D. H. Holton, H. R. Warner. The Permanent Secretary of the American Medical Association is vested with the power of adding a few names to this list.

At the meeting of the International Medical Congress in Brussels, Sept. 22, 1875, two of the delegates of the American Medical Association were nominated honorary presidents; and one of them, Dr. I. A. Adrian, presented the following address, delivered in French:

Mr. President:—For three years the American Medical Association has sent its delegates to the British Medical Association, and other kindred European societies, with the special object of asking their concurrence and coöperation in maturing a plan of uniformity of instruments, scales, tables, and records of clinical observation.

The American Medical Association hailed with fraternal feelings the call for this International Medical Congress, and with hopes—your first programme containing a motion to create a uniform method of measuring the defects of audition—this being part of the programme of unity of all the means of observation advocated by the American Medical Association; we cannot help feeling that if you find that part of the plan right, you will have stronger reason to support *the whole.*

The medical profession would find many advantages occurring from the adoption of this uniformity; common measures

would restore the communication of thoughts between us better than a common language.

Mothers and nurses could be made useful recording assistants, by giving us the true signs and symptoms previously to and between our visits, and they would soon comprehend the true nature of disease and cure, instead of falling into the supernatural notions which are now forced upon them.

For these and other reasons, the American Medical Association urges upon the International Medical Congress the necessity of organizing an International Commission, having for its object to devise a plan of uniform means, instruments, and scales, of clinical observation, and to report on the same at the next meeting of the International Medical Congress.

Then Dr. E. C. Harwood introduced the following complementary remarks:

Mr. President:—I have nothing to add to what my colleague has said in regard to the absolute necessity of establishing a uniformity of observation and of method of record of observation among the physicians of all the countries where our art is founded on the natural sciences. It remains only for me to urge the other—though almost identical—necessity of the acceptance of the metric system by the English-speaking nations. This acceptance by the American people was delayed by our natural habit of following in the footsteps of the mother country; but the time has now come when parent and offspring must no longer remain in opposition to the metrical system. We might just as well set ourselves in opposition to gravitation; except that we can, as two great nations, delay and retard a matter of human progress, while we could not retard gravitation.

When I say that I am heartily in favor of the metrical system, I think that I represent the sentiment of my countrymen in the medical profession. We desire to see it introduced into our country as rapidly as it can be done wisely. Our colleges and high schools all teach it, and should be earnest advocates for its more permanent introduction into our public schools, since all such reform must be forwarded by incoming generations, leaving the old system to die out gradually with the generations as they pass away.

Here closes the medical campaign of 1875; and that of

1876 will open in Philadelphia, where the idea of *uniformity of medical observation*, being on its native ground, is expected to take root, and to become a medical reality. That will be the test of the amount of philosophy in physic at the close of this century.

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